

# The Chemical Age

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## Notes and Comments

### Rating and Valuation

IN the annual report of the Central Valuation Committee for 1931-32, which has just been published by H.M. Stationery Office, there is a recommendation to the Ministry of Health which dashes all hopes regarding any possibility of the postponement of the new valuation lists beyond April 1, 1934. In this report it is pointed out that those local authorities who advocated a postponement late in 1931 did so principally on the ground that there was special and immediate need for economy. Another reason advanced was that our departure from the gold standard, under the economic conditions which prevailed, might possibly result in a general alteration in the rental values of property, the hope being expressed that better and more stable conditions would be found if the preparation of the new lists was deferred until 1936 or 1939. The Central Valuation Committee, however, have displayed the typical attitude of bureaucrats. "Postponement," they say, "cannot be regarded as affording a satisfactory alternative to a general periodic survey of assessments." The committee has come to the conclusion that "the disadvantages and injustices which would arise from a postponement of the new lists outweigh any argument in favour of such a course." The urgent need of the moment is therefore a fighting campaign throughout the country, having as its object the reduction of assessments. The amount received by local authorities on account of rates for the last financial year was higher than at any time in the last ten years, being nearly £4 10s. per head as compared with £1 19s. in the year 1914. When this abnormal increase in rates is placed alongside the abnormal decrease in profits suffered by traders during recent years, it will be obvious that the burden borne by the traders is an unjust one.

### Colloids and Textiles

THE largest conference which has yet taken place on physics and colloid chemistry in special relation to textile materials has been arranged by the Faraday Society and will be held in Manchester from September 21 to 23. During these three days, about twenty-eight papers will be read and discussed by English, German, French, Dutch and American research workers. Colloid physics and chemistry have made great strides in recent years, especially since the British Association published the first report on colloidal chemistry and its industrial application, in 1917. Since that occasion there have been four other reports by the Department of Industrial and Scientific Research, and the subject is now applied in some degree to almost every industry, including

agriculture, rubber, printing, photography, road surfacing and bread-making! Directly or indirectly, colloids have a bearing on everything, and they are particularly important in relation to textiles. The making of creaseless cotton, which was recently announced, entailed considerable application of physics and colloid chemistry in the investigations which evolved the processes. The world war was also an immense stimulus, and the research associated with cordite, was ultimately extended after the war by the British Cotton Industry Research Association, and the Linen Industry Research Association, tests being devised which now enable the chemist to say with absolute certainty whether damages or defects in cotton, linen, or artificial silk yarns or fabrics had been caused chemically, mechanically during processing, or simply by wear or laundering. Manchester business men were also quick to realise the industrial importance of colloid physics and of colloid chemistry, and a lectureship in the subject was endowed by them at Manchester University shortly after the war. It is in the Department of Chemistry at Manchester University that these meetings of the Faraday Society will be held, under the chairmanship of Professor F. G. Donnan.

### Research on Refractories

CONSIDERABLE progress has been made in recent years by the manufacturers of refractory materials in regard to the improvement of existing refractories and the development of new types. This work has been very materially assisted by the research that has been carried out by the British Refractories Research Association. The amount of development work that is carried out by individual manufacturers increases each year, and consumers have noted a growing activity in this direction, and a desire to encourage technical co-operation with the consumer with the object of ascertaining accurate scientific information about the conditions and achievements of refractories in service. According to Sir Robert Hadfield and Mr. R. J. Sarjant, who deal with the subject of refractories for high temperature work, in the current issue of "Fuel Economy Review," one feature of this co-operation appears noteworthy. The consumer is naturally mainly interested in determining the service obtained from his refractories on the basis of initial cost. It would appear therefore that he has a relatively simple means of satisfying his needs by trying out, in a series of service tests, all the refractories that salesmanship can prevail upon him to try, until he has found the most suitable. This often happens in practice, but there should be a more scientific manner of approaching the subject.

Whilst in the present state of knowledge the service test must remain the ultimate arbiter in the selection of refractories, there is a danger that test on chance performance alone may involve a multiplicity of conflicting factors, and results may be misleading. Indeed, the method, whilst convenient, must be wasteful of effort in the long run, not to mention disastrous possibilities, where totally unsuitable material is used blindly. Tests must run into months, even years, and it is easy to understand how conditions may change to upset the value of the conclusions.

### Specifications for Refractories

THE number of consumers who have instituted technical organisations to examine the economy and progress of their practice in the use of refractory materials continues to increase. The question of specifications may be controversial. Too rigid adherence to defined limits may hinder progress, but there is much to be said for the practice, particularly as it promotes the scientific study of the material both by manufacturer and user. During the year considerable progress has been made in research, notably through the British Refractories Research Association in collaboration with the Institution of Gas Engineers and the National Federation of Iron and Steel Manufacturers. Valuable progress has also been made in the study of gas permeability, which is a governing factor in its industrial significance as regards gas or air leakage in retorts and furnaces, and in the deterioration of a refractory product by the penetration of corrosive vapours or even fine solid particles. A number of interesting and valuable conclusions has already emerged from this work. There appears to be no definite relationship between porosity and permeability in the case of either fireclay or silica products. A diatomite insulating material having a 70 per cent. porosity has a surprisingly low permeability. The character and continuity of the pore system is the governing factor, and this is governed by the grain size and grading of the raw batch materials, the manufacturing processes, and the firing period. The permeability of the product also decreases as the temperature rises, for in general, a temperature rise to 500°C. was found to reduce the permeability to about one half its value at 10°C., such a change being largely independent of the nature of the material. Hot patchings, the action of carbon monoxide on refractory materials, the nature of the iron compounds responsible for the disintegration of refractories, and the development of chrome silica bricks, are other salient features of this programme of research.

### Rubber Latex Developments

RUBBER roadways are promised by latex, the milk of the rubber tree, according to technical developments in the United States and Europe made public by the American Chemical Society. Pavings of rubber which could be applied in the same manner as is asphalt would appear to be a very interesting type; such pavings are being investigated in America, and have been tried on an experimental scale in Singapore. Somewhat similar is the use of latex in compositions for covering athletic grounds and for filling expansion joints. Given the proper economic conditions, it is not outside the realm of possibility that the direct

use of latex could accomplish a revolution in the rubber industry. That latex may even be of service as a lubricant, when mixed with petrolatum, is indicated by preliminary experiments conducted by the Rubber Growers' Association. Poros ebonite, made from latex, may be used in the manufacture of light rubber board for airplanes. One of the largest uses, however, is in the manufacture of adhesives and sealing compounds. Practically all the sealing compounds are used in the sealing of cans. Cements made from latex have found numerous other applications. A mixture of latex and bentonite clay provides an adhesive for attaching paper labels to tinned containers. A latex adhesive for envelopes, it is claimed, is economical and will retain its adhesiveness for five years if kept free from dust. Latex cement is utilised in the shoe industry, in which there are many possibilities of additional uses. Composition soles may be made by using latex either with felt, with long cotton fiber, with tire scrap, or with silicon carbide or other abrasive substances. Soles made of felt and compounded latex, are said not to mark floor surfaces, to be water-proof, and to be free from a tendency to spread. Latex is also making progress in tire and tube manufacture, for the latex used in impregnating cord fabric constitutes a considerable proportion of the total amount imported into America. Other latex products for the motor car industry which have been developed beyond the experimental stage include the latex-bonded brake and clutch linings. It is being utilised in the production of the sponge-rubber seats; in the insulation industry; in paint manufacture; in the paper and rayon industries; in the manufacture of carpets, rugs, and rubber floorings; in textiles, and in a great variety of other products. An even more radical suggestion is the sealing of tropical fruits in a film of dried latex before transporting them. The direct utilisation of this liquid in rubber and other industries has had such rapid advance that 9,190,000 lb. of rubber in the form of latex, were imported into the United States in the first ten months of 1931. It is significant to note that the importation of latex was 19.3 per cent. greater in 1930 than in 1929, despite the fact that the consumption of crude rubber decreased 20 per cent.

### New Uses Wanted for Arsenic

AT the recent annual meeting of an European ore-mining company, it was revealed that 400,000 tons of arsenic ore per year would be dealt with as from the commencement of 1833. The ultimate destination of the enormous quantities of arsenic which will be produced is a question of outstanding interest. We hope that the company which is concerned will find new uses for arsenic which will make it possible for them to dispose of their stocks on the world market. In the event of this being unsuccessful, arsenic will only follow in the footsteps of mercury. In both of these cases there is an attractive opening for chemical invention. At present arsenic is used in medicinal preparations; in lead alloys for bullets and shots; pyrotechnic compositions; as a dipilatory agent; in the manufacture of paint pigments; the dyeing of textiles; calico printing; as a bronzing agent or decolourising agent for glass; in the manufacture of opal glass and enamels; for insecticides, vermin poisons, sheep dips and boiler compositions.

## Aluminium as a Heat Insulating Material

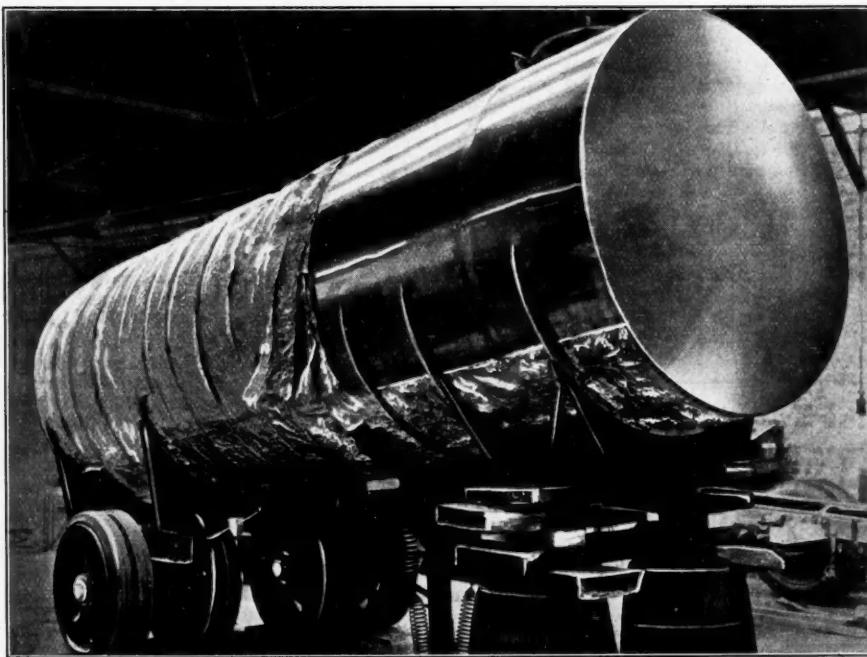
### Advantages of the Alfol System

The following article is based on information supplied by The British Aluminium Co., Ltd., and Alfol Insulation, Ltd. It describes a relatively new development in heat insulating materials, and is specially of interest to all users of steam and steam-heated or refrigerated chemical plant.

OF the three methods of heat transference—radiation, convection and conduction—which have to be taken into account when considering systems of insulation, it is radiation which is the most potent factor in the majority of cases. As a means of counteracting radiation, a material is required with low powers of absorbing and emitting heat, and such a material is found in aluminium, whose bright surface is noted for its high heat reflectivity. This property must not be confused with that of heat conductivity: the metal is, of course, of high conductivity, but its emissivity is extremely low, and its reflectivity high.

Even in the form of paint aluminium retains this quality, which largely accounts for the popularity of aluminium paint for coating water pipe-lines, vehicle roofs, and aircraft

fitted for use for this purpose, owing to its high heat reflectivity and freedom from tarnishing, its low weight, and the fact that it is available either as sheet or foil or as a sprayed coating. The method of insulation evolved depends upon thin strata of air separated by extremely thin metallic layers, the high efficiency thus obtained arising from the fact that, whilst radiation is checked by the bright metallic surface, the still air is practically a non-conductor, convection being prevented by the isolation of the different divisions from each other. In the search for the most practicable way of applying this principle thin aluminium sheet was first tried, but it was later perceived that aluminium foil would be a more economical and in many cases a more suitable material to use, and this resulted in the development of "Alfol."



Alfol Insulation in course of being applied to a 2,000 gallon Milk Transport Tank

fabric, where a certain amount of protection from heat is desired. It is in the case of polished sheet or foil that the heat reflectivity is greatest, however, and this has been taken advantage of in the transport of petrol, for instance, losses through volatilisation being greatly cut down by using aluminium tanks covered only with colourless lacquer. Similarly, aluminium foil has been successfully tried in America for coating oil tanks as a preventative of evaporation and corrosion, but for certain purposes such as refrigeration and the conservation of heat in steam vessels, the insulation must be very thorough, and the medium employed has to be such that it positively resists any change in temperature whether through radiation, convection or conduction. The only insulating materials previously available satisfying this requirement are such that the very bulk and weight required tend to make them rather impracticable and uneconomical in use.

#### Nature of Alfol Insulation

It has long been known, however, that the heat-conducting capacity of still air is very small, and it was upon the basis of this fact that a series of investigations were carried out some years ago in Germany with the object of developing a new insulating medium combining layers of air with polished metal strips. It was discovered that aluminium is peculiarly

As originally developed, Alfol insulation consisted of concentric layers of aluminium foil wound over non-metallic separators. In this form, however, the material was applicable only to straight pipes or other bodies of regular shape. In view of this limitation, the system was modified to dispense with the separators and to use crumpled foil, as even in this latter simplified form Alfol was found to provide perfectly efficacious insulation. In the present Alfol system, the aluminium foil is obtainable in rolls of handy size, highly polished and ready for application. This foil is approximately 0.0003 in. thick (0.007 mm.), and is embossed with a diamond pattern, which, besides constituting a trade mark, assists in the crumpling operation. The latter is carried out by means of sideways compression with the hands, the crumpled sheets of foil then being wrapped round the body to be insulated, placed upon each other so that only the ridges of the different layers are in contact. Three layers of foil make up about an inch of insulation thickness, and provided that they are applied carefully so as to ensure the retention of the air layers, this amount will frequently suffice for many insulation purposes. The insulation is, of course, protected in the usual way from damage by a strong cover or steel lagging.

The high insulating power of Alfol is attributed to the heat reflecting power of the bright metal surfaces, the low

conductibility of the intervening air layers, and to the fact that conduction losses are negligible owing to the thinness of the foil and to the minimising of contact between the sheets. A test made at the National Physical Laboratory with a steam pipe 4.5 inches in diameter, heated to from 477° to 730° F. above the outside air and insulated with 2 in. of Alfol, showed a saving in heat loss compared with a bare pipe of from 93.5 to 95 per cent. Another test at 27° F. gave a figure of heat conductivity of 0.29 B.Th.U. per inch thickness per square foot per hour per degree F. difference in temperature, while the radiation from Alfol has been found to be only 4 to 5 per cent. of that from a black body.

#### Unaffected by Vibration

An important point in connection with Alfol is that in spite of its structural composition it is not affected by vibration and does not flatten out. The German Government Material Testing Office, Berlin-Dahlem, subjected a wooden box fitted with Alfol to 40,000 shocks per hour for 50 hours by means of a special vibrating appliance, but no perceptible alteration was produced in the insulation. This is of peculiar significance in view of the great potential value of the material for insulating road and railway vehicles, and in this connection its lightness is also of value. It is over 90 per cent. lighter than other insulating media, weighing only 3 oz. per cubic foot.

The Alfol system of thermal insulation has been patented throughout the world, and its applications are being developed in many countries, including England, Denmark, France, Germany, Holland, and the United States. It has been successfully employed for practically all insulating purposes, from refrigeration to low-temperature carbonisation work and covering all phases of road, rail and marine transport and innumerable applications in connection with steam pipes and vessels. In this country it is rapidly gaining in popularity in all fields of heat insulation, especially for road tankers for the transport of liquids in bulk. For such a purpose Alfol provides the advantages of lightness and durability. Consisting solely of aluminium foil, it will not absorb moisture in the event of a leakage, and is clean, odourless and non-inflammable.

### Chestnut Tanning Extract

#### III-Effects of Using Unbarked Wood

CHESTNUT wood extract is one of the most widely used tanning materials in the leather industry, large quantities being manufactured in France, Italy, America and Corsica. It is usually considered as a pyrogallol tannin, but Dr. A. Ponte, in "J. Soc. Leather Trades Chem." 1932 16, p. 394 points out that about 4 per cent. of the tannin may be of the catechol class. If, in the manufacture of the extract the bark is not removed, this figure may rise to a little over 7 per cent., chestnut bark extract itself containing up to 25 per cent. of catechol tans (based on total tannin). From the point of view of quality of finished extract, it is considered desirable to remove the bark completely, as its presence during extraction results in an extract higher in ash, lime, iron and copper than that prepared from the wood alone. The copper content of chestnut bark extract is very high due to (a) the initial high content in the bark itself, and (b) corrosion of copper autoclaves during extraction. The latter is induced by the presence of free and combined polybasic oxy-acids aided by atmospheric oxygen which finds its way into the extracting system. For the latter reason, it is bad practice to move liquors through the extraction battery by air instead of steam.

Acetic acid, which is also responsible for some corrosion of the plant, is produced from the wood as the result of bacterial fermentation during storage of the chips, as there are organisms which are capable of fermenting such carbohydrates as maltose, dextrin, etc., directly into acid. Acetic acid itself is not present in the wood, and long storage, *i.e.*, over three days, must be avoided. The use of unbarked wood also gives a dark coloured extract, the red colouring matter being associated with the catechol tannins introduced. Although complete barking of the wood is an expensive operation, and entails a loss of tannin (chestnut bark contains 10 per cent. tannin), such a practice is being adopted in Italy with a view to the production of a better quality extract.

### Manufacture of Zinc Oxide

#### Utilisation of Zinciferous Clay Slimes

THE Belgian Société des Mines et Fondries de Zinc de la Vieille Montagne has installed and recently put into operation in Moresnet (Province of Liège), Belgium, a factory designed to manufacture zinc oxide. The interest created by the installation of this plant is due as much to the novelty of the application of the process used as to the advantages derived from the method, which permits profitable utilisation of materials hitherto considered valueless. Interesting details of the procedure have been reported by N. Orban, chief engineer of the company, in a recent issue of "Annales des Mines de Belgique."

The residues treated (slime too fine to be enriched by washing) consist of zinciferous clay which contains from 10 to 13 per cent. zinc in the form of silicate and approximately 45 per cent. silica, 15 per cent. alumina, 6 per cent. iron and 1 to 1.5 per cent. lime. This is practically free from lead, sulphur, or other deleterious substances, and is intimately mixed with coke dust, and then passed into a slightly inclined rotary kiln in which it travels while subjected to an increasing temperature, heated by pulverised charcoal. In the reaction zone where a temperature of about 1,250° C. is attained, the substance undergoes reduction. As soon as the metal is liberated, it passes into the oxidising zones of the kiln and the oxide formed is carried off by the escaping gases. The slag, or residue from the process, is pasty and is continuously and automatically evacuated at the base of the kiln.

#### The Walz Process

The application of the Wälz process permits the use of ordinary equipment. A preliminary kneading of the zinciferous slime and finely pulverised coke (a mixture of 35 parts coke to 100 parts moist slime) is followed by working in a kneader which has a perforated bottom on which revolve two heavy circular wheels with a horizontal axis. The perfectly homogenous mixture is then placed in a kiln similar to cement kilns, measuring 40 metres in length and 1.85 metres in diameter, the lining of the upper half of the kiln being of bricks containing 42 per cent. alumina, and in the lower half 36 per cent. alumina. The gases, which escape laterally from the top of the kiln, first pass through a deposit chamber where the most granular dust is deposited, this dust, which is not sufficiently rich in zinc, is scraped up by an endless screw device and is used again in the process. When they leave the first deposit chamber they pass into a Cottrell installation where the fine zinc oxide (99.6 per cent.) is entirely precipitated. A last chamber retains the particles which have escaped electrical precipitation; and the gases which leave this chamber with dust particles thoroughly removed are released into the atmosphere. The installation treats an average of 130 tons of calamine slime per day. The oxide produced contains 60 per cent. zinc, and the "metal" yield of the operation varies between 85 and 90 per cent. The unrecovered zinc remains in the slag.

### Manufacture of Cyanamide

#### Simultaneous Isolation of Pure Hydrogen

A NEW I.G. process for the manufacture of cyanamide, which also results in the isolation of hydrogen gas in a pure form (English Patent No. 368,424) is based upon the reaction between ammonia, an aliphatic unsaturated hydrocarbon and a carbonate of an alkaline earth metal at temperatures between 400° and 1,000° C.,

$\text{CaCO}_3 + 2\text{NH}_3 + \text{C}_2\text{H}_2 = \text{CaCN}_2 + \text{CO} + \text{CO}_2 + 4\text{H}_2$ .

Suitable hydrocarbons in addition to acetylene include ethylene, propylene and butylene, and the reaction is favourably influenced by the phosphates of copper, iron and molybdenum. Reference to this process appears in "Metallbörse" (August 3) where it is pointed out that it closely resembles that of the Bayerische Stickstoffwerke, whereby carbonate and ammonia react together in a carbon monoxide atmosphere. This older process, however, did not permit of the separation of hydrogen. Attention is also drawn to an earlier cyanamide synthesis (German Patent No. 549,030) involving passage of cyanogen over oxides of the alkaline earths at temperatures above 300° C.

## The True Nature of Gelatine

### Investigations by the late Professor S. B. Schryver

We give below extracts from Appendix II to the "Third and Final Report of the Adhesives Research Committee," wherein the investigations of the late Professor S. B. Schryver, D.Sc., F.R.S., are recorded.

KNOWLEDGE of glues has been considerably limited by uncertainty as to the true nature and physical properties of gelatine, which is the chief constituent of this class of adhesives. This uncertainty is mainly due to the great difficulty of separating gelatine as a definite chemical entity from the complex mixture in which it is usually found in the commercial glues and gelatines. Such a mixture arises primarily from the fact that gelatine is obtained from precursors, such as ossein (from bones) and collagen (from skins), by the action of hot water. This brings about a chemical change both in the precursor and in the gelatine, as it is formed. The gelatine therefore undergoes certain transformations, and there results a mixture containing a number of products, most of which are of complex chemical nature. In addition to the gelatine and the products produced directly therefrom by the action of water, commercial preparations also contain substances such as chondroitin, sulphuric acid, "extractives," etc., which accompany the ossein or collagen in the tissues, and which, as a rule, have not been completely removed before the conversion of the precursors into gelatine.

In order to be able to correlate the various properties of commercial glues and gelatines with their chemical composition, as adhesives, it was therefore necessary to separate gelatine from other accompanying products and to study its properties in detail. When a gelatine of high degree of "purity" had been isolated it was found that, under certain conditions it readily underwent certain intramolecular changes. The chemical problems connected with gelatines and glues are therefore particularly complex, for samples of glue or gelatine may differ from one another not merely in the relative amounts of gelatine and other products present (which may be conveniently referred to as "impurities"), but the gelatine isolated in different cases may be varying mixtures due to the ease with which intramolecular changes take place, and to the fact that such changes may actually occur during the processes of the isolation and purification of the gelatine.

#### Intra-molecular Changes of Gelatine

For purification purposes the gelatine was first treated with  $N/1,000$  hydrochloric acid, according to the method of Loeb. Thin sheets were employed, and these, after washing with acid and subsequently with water, were considerably swollen. They were melted, and the gelatine solution thus obtained was concentrated *in vacuo* at  $40^{\circ}\text{C}.$ , until a 20 per cent. solution was obtained. This formed a firm gel on cooling, which was then submitted to electrolysis for several days. By this means a product was obtained, of which the ash content was 0.025 per cent., or even less. This still contained, however, nitrogenous products other than gelatine, which could not be removed by the process of electrolysis. These nitrogenous products were partly removed by a process of cooling solutions of low concentration (1 per cent.) when the filtrate from the separated flocculum contains appreciable amounts of nitrogen. The flocculum, after washing on the filter paper, was then redissolved in 50-100 times its weight of water by warming to  $30^{\circ}\text{C}.$  and, on cooling such a solution, the gelatine readily separated again, with the filtrate from this flocculum containing nitrogen in still smaller quantities.

Gelatine can also be made to flocculate more rapidly by submitting its solutions to the influence of an electric field. (Knaggs and Schryver, "Biochem. J.", 1924, 18, 1079), but the nature of the resultant flocculum is determined by the conditions under which flocculation takes place, *i.e.*, whether cationically (from a solution of the hydrochloride) or anionically (from a solution of the sodium salt).

In order to test various samples of gelatine obtained, recourse was had to what is probably the simplest method of chemical analysis that is applicable to the proteins. This consists in the determinations of the factors generally known as the "Haussmann numbers." By means of this process, the hydrolysis products of the proteins are separated into four fractions, *viz.*, the humin, the amide, the diamino, and the residual nitrogen fractions. It was noticed at an early stage

of the investigations that very variable members could be obtained from the same sample of gelatine, when attempts were made to determine the Haussmann factors, even when the most modern form of the Haussmann method was adopted. In order to ascertain the reasons for this discrepancy, an investigation was undertaken by J. Knaggs ("Biochem. J.", 1923, 17, 488), who discovered that when gelatine was allowed to stand with hydrochloric acid (the acid used for hydrolysis) in the cold, before heating to perform the hydrolysis, distinctly larger numbers were obtained for the basic (diamino-acid) fraction, than were obtained when the gelatine was hydrolysed by throwing it directly into the boiling acid. The figure in the first case was as much as 50 per cent. over the amount obtained by following the second procedure, *i.e.*, the diamino fraction approximated to 30 per cent. of the total nitrogen, instead of 20 per cent.

#### Effect of Acids before Hydrolysis

A detailed investigation on the effect of standing with acid of varying concentrations, on the products of hydrolysis was carried out by Thornley ("Biochem. J.", 1927, 21, 1302), who found that an increase in the diamino-fraction could be produced by relatively weak acids. There is, therefore, no doubt that intra-molecular changes in gelatine are readily produced by acids. There is also a certain amount of evidence that similar changes can take place in the precursors of gelatin (ossein) during treatment by acids and alkalies, causing differences in the character of the gelatine obtained, subsequently, by the action of water. (Knaggs and Schryver, "Biochem. J.", 1924, 18, 1096).

The work summarised above was called in question by Daft ("Biochem. J.", 1929, 23, 149), who published results which apparently showed that no increase in diamino-acid nitrogen was produced by treatment of gelatine with cold acid before hydrolysis. Similar observations had previously been made in isolated cases (cf. Knaggs and Schryver, "Biochem. J.", 1924, 18, 1102). The whole matter has therefore been subjected to a re-investigation by Thimann ("Biochem. J.", 1930, 24, 357, 368) who determined the amount of nitrogen precipitated by phosphotungstic acid by (i) using samples of phosphotungstic acid of different origin; (ii) carrying out the precipitation at different temperatures; (iii) heating the acid solution in an autoclave before carrying out the precipitation; (iv) using solutions containing different concentrations of nitrogen. From the results obtained in series (i) to (iii) it appeared that important variations in "diamino-nitrogen" were not due to these differences in treatment. On the other hand it became very clear that the concentration of nitrogen in the solution in which the phosphotungstic acid precipitation was carried out was of the highest importance in determining the amount of "diamino-nitrogen." The amount of phosphotungstic acid precipitate varied almost continuously with the concentration of nitrogen in solution as the concentration was increased, the amount precipitated rose rapidly, reached a maximum, and then slowly decreased, this decrease being ascribed by Thimann to the formation of soluble phosphotungstates containing a higher proportion of diamino-acid.

#### Precipitation Curves

It is now therefore concluded that it is necessary to plot the curve for "nitrogen concentration" against "percentage nitrogen precipitated" (diamino-nitrogen) in order to obtain information of any value, single determinations of "diamino-nitrogen" having no significance. Further, similar precipitation curves were worked out for the individual diamino-acids, arginine, histidine and lysine, and for proline, and shown to be characteristic in each case. A comparison of these precipitation curves with that of a protein furnishes some indication of the amounts of the various diamino-acids present in the protein. Precipitation curves were obtained also for samples of gelatine which had been subjected to pre-treatment with cold acid. These were found to differ very considerably from

those for untreated gelatine of known origin; the differences were obvious when the precipitation was carried out in a solution containing a low concentration of nitrogen. At higher concentrations of nitrogen, the curves for both pre-treated and untreated gelatine were similar. The curves themselves indicated that acid treatment had caused an increase in the amounts of lysine and proline present.

#### Anionic and Cationic Forms

As gelatine is an amphotyte, it can form salts with both acids and bases, acting in the former case as a cation, and in the latter as an anion. A certain amount of evidence exists to indicate that the structure of gelatin differs according to whether it acts anionically or cationically. An investigation was therefore undertaken to ascertain whether this were actually the case. For the purposes of the experiment a gelatine was employed which had been purified by electrolysis and flocculation in an electric field, by the method already described. One portion of this was converted into the hydrochloride, and the other into the sodium salt; from a solution of the hydrochloride the gelatine was brought down at the cathode, and from a solution of the sodium salt at the anode by electrolysis. From the hydrochloride, the gelatin separated in the form of a compact gel, with very little nitrogen in the supernatant liquid. From the sodium salt, on the other hand, the gelatin separated as a bulky flocculum, with appreciable amounts of nitrogenous matter in solution in the water.

This flocculum was found to be soluble in water only to the extent of 15 parts in 100,000. The aqueous solution, from which the flocculum separated, was found to contain a highly complex protein, extremely soluble in water, the concentrated solutions of which did not form a gel. It is not possible at the present stage of the investigations to give a definite interpretation of the results. It appears as if the gel is a combination of a soluble product ("metagelatine"), with an insoluble product, these two substances remaining combined when they are brought down cationically by the electrolysis of the hydrochloride. When, on the other hand, they are brought down anionically, the two fractions separate, and there is evidence that the intramolecular arrangement is different in the cationic form of gelatine, from that in the anionic form. Only in the former case do the soluble "metagelatine" and the insoluble gelatine remain combined. When once these two fractions have been separated they could not be re-combined, and in this particular form of combination gel structure is exhibited. The soluble "metagelatine" appears to be formed by the action of water on the insoluble gelatine, and there is evidence that the latter cannot be dispersed in water at 30° C. without an appreciable amount of change into the former taking place (Schryver and Thimann, "Biochem. J.", 1927, 27, 1284).

#### Separation of the Hydrolysis Products

The chief method in use for the separation of the products of hydrolysis of the proteins, available when the researches were commenced, was that of Emil Fischer, which consisted in the conversion of the mixture of amino-acids resulting from hydrolysis into their esters, and the separation of the esters into various fractions by distillation in high vacuum. By reason of the difficulties entailed by this manipulation, the separation effected by this process is very incomplete, and some of the amino-acids form esters which do not distil without decomposition, even under very low pressures, and have therefore escaped detection. Attempts were therefore made to evolve methods of entirely new character, in which the process of distillation of the esters could be entirely discarded.

In the first instance an attempt was made to employ what may be conveniently described as the "carbamate" method. By this process the amino-acids are obtained in the form of their barium carbamates, by treating their solution in ice cold 80 per cent. alcohol with barium hydroxide and carbon dioxide alternately. Its main use lies in the fact that it renders possible the separation of glycine, which alone among the amino-acids gives a barium carbamate which is insoluble in ice-cold water. Satisfactory methods were already available for the separation of the dicarboxylic amino-acids (e.g., Foreman, "Biochem. J.", 1914, 8, 463; Dakin, "J. Biol. Chem.", 1920, 44, 499), and for the removal of the diamino-acids from the mixture of hydrolysis products,

though not for the complete separation of the individual members of this latter group. On the other hand no technique hitherto available seemed suitable for the complete separation of the majority of the mono-amino-acids (e.g., alanine, valine, phenylalanine, serine, etc.). Accordingly, attempts were made to devise a process for fractionating a mixture of these substances, avoiding the difficult and wasteful esterification process. Briefly, the methods adopted consisted in the fractionation of the various amino-acids in the form of their copper salts (or in certain cases their zinc salts), advantage being taken of the different solubilities of the copper salts of the individual amino-acids in certain solvents, particularly water, absolute alcohol and methyl alcohol.

All the mono-amino-acids are converted into their copper salts by boiling the aqueous solution with excess of copper carbonate; the filtered solution of the copper salts thus obtained is evaporated to a thick syrup, which is then dried very thoroughly by means of acetone. By this means the mixed copper salts are obtained in the form of a fine dry powder, the complete dryness of which is essential to the success of the further fractionations. The mixed copper salts are then divided into three fractions, according to their solubilities.—(1) Soluble in water and in dry methyl alcohol; (2) soluble in water and insoluble in dry methyl alcohol; (3) insoluble, or sparingly soluble, in water and in methyl alcohol. The first fraction contains the proline, valine and hydroxyvaline which may further be separated by reason of the fact that proline alone is soluble in absolute alcohol and may be purified by precipitation as picrate from the alcoholic extract. The second fraction contains glycine, alanine and serine (with glutamic acid and the bases, unless these have been removed previously). The third fraction contains leucine and phenylalanine (with aspartic acid, if present).

#### International Nickel Co. of Canada Quarterly Statement

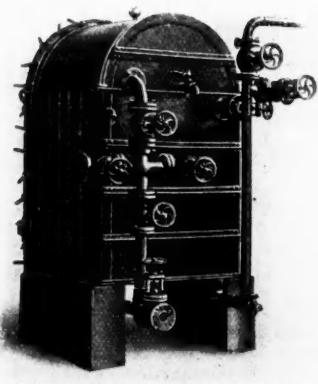
FOR the first time since the re-organisation of the company in 1928, the International Nickel Company of Canada, Ltd., has to report a loss in the quarterly statement covering the period ended June 30 last. Total income for the three months was only \$489,384, compared with \$1,767,667 in the previous quarter and \$3,312,288 for the corresponding quarter last year. In place of a net profit of \$536,072 earned in the previous quarter, there was a net loss, after deductions for taxes, interest, depreciation, depletion and other reserves, of \$629,327, and a net loss for the first six months of this year of \$933,255. Net operating income for the quarter was \$204,211, and for the half-year \$1,630,044. These figures compare with \$1,425,834 for the quarter ended March 31 last and \$5,544,476 for the first six months in 1931. The earned surplus on June 30, after making provision of \$483,475 for the Preferred dividend paid on August 1, was \$15,697,599, a decrease of \$1,112,802 from that at the end of the first quarter and \$2,967,861 less than the earned surplus for the first six months of last year. The cash position of the company has been strengthened during the quarter by the addition of \$188,050 to cash and demand loans item, which now stands at \$2,933,260. Government securities are unaltered at \$706,840. Accounts and bills receivable show a decline from \$4,701,715 on December 31 last to \$2,636,422 at the end of June.

In his accompanying letter to stockholders, Robert C. Stanley, the president of the company, emphasises the part which the company's seven development bureaus have played in creating markets for nickel, monel metal and other nickel alloys in the world's principal industrial centres. Nickel information bureaus are now maintained in London, Paris, Frankfurt, Brussels, Milan and Tokyo, in addition to a development bureau in New York, and five plant laboratories and two experimental and testing laboratories. Nickel would not now enjoy its high standing as an alloying element had not the company deliberately organised to bridge the gap between pure science and industrial practices. What is learned in the laboratories and in the field is codified and made known to both the scientists and the industrialists through the continuous service of the information bureaus in providing literature, illustrated lectures and practical consultations.

## New Equipment for Filtration Problems

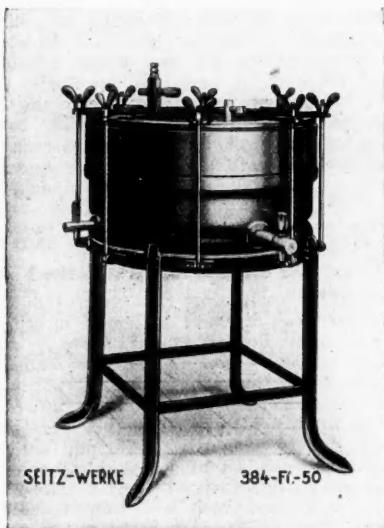
### Utilising Asbestos Filtering Films

THE "Seitz-EK" sterilising filter is a recent development in filtration equipment. This filter is somewhat similar in construction and working principle to a filter press, but operates with ready-made asbestos filtering films. The filtering films are inserted between the filtering screens of the filter and filtration may then be commenced immediately.



Seitz "Hercules" Filter No. 36 : Stationery  
Model with 385 sq. ft. of filtering surface.

The ready-made asbestos filtering films are supplied in a very wide range of porosity. The finest are so sharp in their filtering effect that they render any liquid filtered through them absolutely sterile. In many instances the object of using these very fine sterilising filtering films in the filter is not so much to obtain a sterile filtrate as to impart the highest possible degree of clarity to the filtered product.



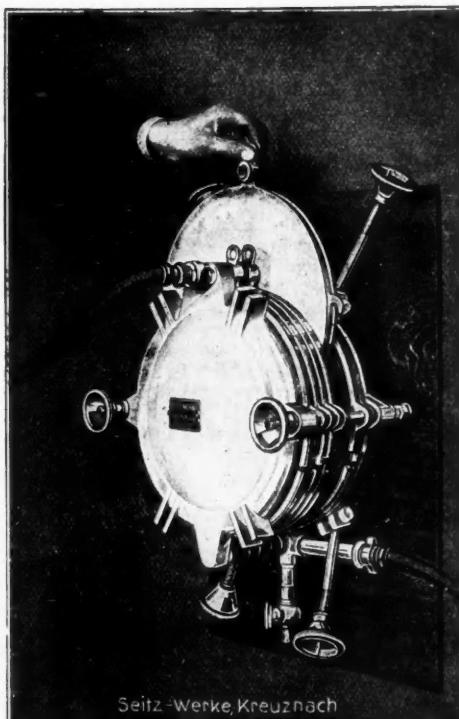
Seitz "Terra" Earthenware Filter, Size III.

With some liquids, however, sterility of filtrate is the main object in view and examples of these are sera, anti-toxins, injection solutions, etc., and fruit juices, cider, beer, etc. Filters have been installed for sterilising 400 litres of serum per day. When handling liquids such as cider, 8,000 gallons per day is by no means beyond the capacity of this type of filter which is supplied by John C. Carlson, London.

The coarser grades of filtering films also yield a brilliant filtrate, although not a sterile one. Many filters which have

been installed are used with these coarser films, which are known as clarifying films and are used for the filtration of products which must be as brilliant as possible. In particular, perfumes, photographic chemicals, spirits and all alcoholic preparations are in this category. One of the smallest sizes of this type of filter is illustrated. Normally, the filter is constructed of brass, heavily tinned, but it may be supplied silver-plated and, for special requirements, e.g., the filtration and sterilisation of vinegar, in ebonite.

The Seitz "Hercules" filter is widely used for filtration work where only small amounts of solid matter are to be removed from very large bulk of liquid. This filter operates on the alluviation principle, as opposed to the use of ready made filtering films in the "EK" sterilising filter described above. Again, however, there is a wide choice of porosity in the loose filtering material. Lately it has been possible to make this filter entirely rubber-lined, so that it



"Seitz-EK" Sterilising Filter, size 30/8 with Wall Bracket.

may be used for the filtration of acid liquors. Perhaps the most important application in this respect is the filtration of the various acidic and highly corrosive liquors used in the manufacture of artificial silk. Under this heading are such liquids as spinning bath, hydrochloric acid, sodium sulphite, sodium hypochlorite, all of which have fairly strong corrosive properties. One firm of chemical manufacturers has installed no less than thirty five rubber lined "Hercules" filters, each with 385 sq. ft. of filtering surface. The output of the various sizes of "Hercules" filter is from 2,000 to 45,000 gallons per day. The "Hercules" filter illustrated has a filtering surface of 385 sq. ft.

For handling small quantities of corrosive liquids, the Seitz "Terra" filter, constructed of acid-resisting earthenware, is very valuable. Here the alluviation principle is used, a special filtering material being supplied. This filter is very popular for the filtration of Turkey-red oil, lime and lemon juices and similar liquids. The output varies from 65 to 2,000 gallons per day.

## Letters to the Editor

The Editor welcomes expression of opinion and fact from responsible persons for publication in these columns. Signed letters are, of course, preferred, but where a desire for anonymity is indicated this will invariably be respected. From time to time letters containing useful ideas and suggestions have been received, signed with a nom-de-plume and giving no information as to their origin. Correspondence cannot be published in THE CHEMICAL AGE unless its authorship is revealed to the Editor.

### Safety with Compressed Gases

SIR.—The comments in your issue of August 13 regarding the need for an official leaflet on general dangers and precautions when working with cylinders of compressed gases prompts me to draw your attention to the fact that the absence of just such information led this Association to discuss the matter in Part II of its "Model Safety Rules for Chemical Works," which were drawn up by the Works Technical Committee of the Association of British Chemical Manufacturers and issued to members in 1931. The various precautions advisable during transport, use and storage of gas cylinders are discussed, although perhaps rather more from the point of view of the management than from that of the worker actually using them.

The only other publication dealing with such precautions, on the general lines suggested, of which the Association is aware is Safe Practices Pamphlet No. 95, issued by the National Safety Council of Chicago. Although it is understood that certain companies issue leaflets of their own in connection, for instance, with acetylene and chlorine cylinders, these are not always available to the general public.

A general leaflet on the lines indicated should prove of considerable value, and it is suggested that its compilation could not be in better hands than the Factory Department of the Home Office, which has already produced some very valuable advisory leaflets.

The idea underlying the model safety rules mentioned above is to provide answers to various technical questions arising out of the Chemical Works Regulations, 1922; to draw attention to certain risks, such as the above, which are not always appreciated; and to bring together in the form of a text book, convenient for every day use and reference, the large amount of valuable information regarding safety measures in chemical works which is either available only in scattered publications and reports or which, while in the possession of individual manufacturers, or of the Government departments concerned, remains unpublished for lack of a suitable medium. These rules, accordingly, contain a considerable amount of technical information relating to unusual risks not available elsewhere.

Although originally prepared for the private use of members of the Association, the Council have decided, in view of the importance of questions of safety, to supply copies to outside persons who may be interested, at a cost of 5s. for Part I and 21s. for Part II.

The Association also issues "Safety Circulars" dealing with outstanding accidents or items of interest, and a quarterly safety summary of general information, based on the model rules. These are also purchasable by non-members, and further particulars can be obtained from the Association.—Yours faithfully,

ALLEN J. HOLDEN.

Acting Secretary,  
Association of British Chemical Manufacturers,  
166 Piccadilly, W.1.

### Rail and Road Transport

SIR.—A special meeting of the National Council of the Commercial Motor Users' Association, attended by representative haulage contractors and ancillary users from all parts of the country, was held in London on Monday, August 22, to consider the report and recommendations of the Conference on Rail and Road Transport, when the following resolutions were adopted:—

(1) "The National Council of the Commercial Motor Users' Association do not accept Part II of the report of the Conference on Rail and Road Transport dealing with the incidence of highway costs because:—

- (a) They do not agree the assumptions upon which this part of the report is based; and
- (b) They do not agree that the distribution over the various classes and types of vehicles of any annual amount

which may prove to be properly payable by motor transport is equitable as shown in the report."

(2) "The National Council, whilst supporting the principle that commercial motor vehicles should be maintained in a satisfactory state of mechanical fitness, and that drivers should be in receipt of adequate wages and work under proper conditions of service, do not support the special system of licensing and control recommended in Part III of the report."

A special committee has been appointed to prepare a considered answer dealing with the various assumptions for presentation to an adjourned meeting of the National Council.—Yours faithfully,

F. G. BRISTOW.

General Secretary,  
The Commercial Motor Users' Association,  
50 Pall Mall, S.W.1.

## British Colour Council

### A New Correlation Chart and Standard Card

THE British Colour Council has issued to its members a very comprehensive correlation chart for autumn and winter, 1932. This chart is for use in conjunction with the autumn seasonal cards which members already have. It indicates the correct colours of shoes, bags, hosiery and gloves for day-time wear, with all the fashionable colours for costumes and millinery. A further section of the chart indicates the correct colours of cloaks, shoes and hosiery to wear with gowns of various fashionable colours.

Investigations are also being conducted with a view to issuing a standard card. Information is being received from members, and also from associations representative of industries in which colour is a vital asset to sales. The main object of the production of the cards is to relieve the chaos which now exists with regard to standard colours such as bottle green, saxe, nigger, etc. It is well-known that if a number of firms were asked to supply, say, saxe or any colour which may be regarded as a standard shade, the possibility is that the results would show a diversity of opinion. Not only will the card be useful to the textile and allied trades relative to women's wear, but also to the furnishing and allied trades and interior decoration. The card will be of the greatest value to firms having overseas connections, as the coding of the colours will facilitate speedy and definite communications.

## A.S.T.M. Symposium on Rubber

### Collected Papers now Published

THE twelve papers composing the symposium on rubber held at the recent Cleveland regional meeting of the American Society for Testing Materials are now available in book form. These papers were presented in two sessions—one involved the manufacture of rubber products; the second, the properties of rubber as an engineering material. The authors, all experts in their respective fields, prepared their papers primarily to include data of value to the engineer, not solely to the rubber technologist. The first group of papers deals with the extent and diversity of the industry, crude and reclaimed rubber, vulcanisation, compounding (fillers, reinforcing agents, softeners), and the structures of rubber in combination with textiles and other materials. The second group includes papers on the flexing of rubber products, shock and vibration properties, deterioration of rubber because of friction, chemical resistance, resistance to water and gases, the electrical characteristics of rubber insulation, and rubber as an adhesive. The papers are well illustrated throughout, and valuable data are given in the form of tables and charts.

The book, which runs to 160 pages, can be obtained from A.S.T.M. Headquarters, 1315 Spruce Street, Philadelphia, Pa., at the price of \$1.75 per copy.

## Organic Catalytic Reactions—II

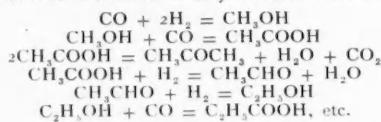
By JAMES A. MITCHELL

The first part of this article appeared in THE CHEMICAL AGE, August 20, page 175. This concluding part deals with the synthesis of the higher alcohols, the hydrogenation of coal and petroleum, and vapour phase oxidation reactions.

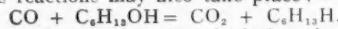
BEFORE Patart had obtained a selective catalyst for the methanol synthesis the Badische Co., in Germany, had investigated the preparation of a mixed hydrocarbon-alcohol fuel, suitable for internal combustion engines. Such a material was obtained by hydrogenating carbon monoxide in the presence of an iron-alkali catalyst at high temperatures and pressures. This product has been called "synthol." After heating in an autoclave this material is converted to "synthin," a product containing more hydrocarbons and more similar to gasoline. Methanol was obtained from this mixture. This process is being thoroughly investigated at the present time, the main interest being in the synthesis of higher alcohols.

Fischer and Tropsch (42) have found that iron is a better catalyst for this reaction than either cobalt or nickel. Enough alkali must be present to convert the iron to ferrite. Using this catalyst various acids, alcohols, aldehydes, and ketones are formed. From experiments on the hydrogenation of carbon monoxide at atmospheric pressure, Fischer and Tropsch concluded that the monoxide decomposes, yielding free carbon which combines with the catalyst to form a carbide, the latter reacting with hydrogen to regenerate the metal with the simultaneous formation of methylene groups which polymerise to hydrocarbons. Formaldehyde or methanol are not intermediate products in the formation of hydrocarbons as no oxygen-containing compounds are formed. Jones (43) has concluded that his observations in connection with the activation of carbon monoxide by charcoal, hopcalite, nickel, and iron offer support for this mechanism.

Fischer (44) found that an excess of hydrogen disfavours the formation of hydrocarbons and the product consists almost entirely of higher alcohols and ketones. He suggests that the mechanism of the reaction may be somewhat as follows:—



With an excess of carbon monoxide a reaction analogous to the water gas reactions may also take place:—



Smith (45) by thermodynamic calculations has shown that it is easier to form the higher paraffin hydrocarbons than the lower members from water gas at all temperatures, that there is a greater tendency to form aromatic than straight-chain compounds, that lower alcohols cannot be formed from water gas at atmospheric pressure and temperatures of 300° and above—although, under these conditions, higher alcohols can be formed. An increase in temperature disfavours the formation of all these materials. Francis (46) has calculated the free energies of formation of nine of the alcohols. Morgan, Taylor, and Hedley (47) state that only primary alcohols are obtained with a catalyst containing alkali, although previous work had indicated that iso-alcohols were formed in abundance. The formation of higher alcohols is favoured by the addition of cobalt to basic zinc chromate.

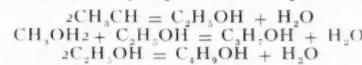
### Promoted Iron Oxide Catalysts

According to Dersin (48) higher alcohols may be obtained from carbon monoxide and hydrogen, using a methanol catalyst, provided the rate of flow of the reactants is slower than that used in the formation of methanol. Frolich and Lewis (49) have shown that there is a "critical temperature" involved in the formation of higher alcohols from carbon monoxide and hydrogen. The high temperature that must be used in order for the reaction to proceed favours side reactions in which carbon monoxide is consumed. Oxide catalysts are better than iron-alkali catalysts; the latter yielding methane and complex mixtures of oxygenated aliphatic hydrocarbons as well as straight-chain paraffins.

Audibert and Raineau (50) have studied the activity of promoted iron oxide catalysts for the production of hydrocarbons and alcohols. Metallic iron alone

produces methane, carbon dioxide, water, and small amounts of organic acids. These workers tested Fischer's "carbide theory" by passing hydrogen over carbonaceous material which had previously been formed by decomposing carbon monoxide on the catalyst. No organic liquids were obtained.

Frolich and Cryder (51) recently published an excellent paper on this subject. They have found that the most effective catalyst for the formation of higher alcohols is a mixture of basic zinc and manganese, carbonates together with potassium chromate. With this catalyst the higher alcohols are formed from methanol by a process of stepwise condensation:



The controlling reaction is that indicated in the first equation, for ethyl alcohol once formed is rapidly converted to higher alcohols. The catalyst is efficient in promoting the water gas reaction,  $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$ , and thus favours the condensation reaction involving the liberation of water. It is also important to note that an excess of carbon monoxide is necessary for the formation of the higher alcohols and its rôle is cleared up by this mechanism. Although small amounts of esters are produced they are not formed by the intermediate formation of an acid from an alcohol and carbon monoxide,  $\text{CH}_3\text{OH} + \text{CO} = \text{CH}_3\text{COOH}$ , but by the condensation of an aldehyde,  $2\text{CH}_3\text{CHO} = \text{CH}_3\text{COOC}_2\text{H}_5$ .

Several investigators have been particularly interested in the preparation of higher hydrocarbons from water gas. Elvins (52) has obtained olefines and subsequent oxygenated products from water gas using fused oxide catalysts. Erdely and Nash (53) have found that cobalt-copper catalysts are effective for this reaction. Zinc oxide and alumina act as promoters, the former being preferable. An excess of carbon monoxide seemed to have an unfavourable effect on the catalyst. Smith, Reynolds, Davis, and Hawk (54) have investigated the efficiency of catalysts of the iron group in hydrocarbon synthesis.

### Hydrogenation of Coal and Petroleum

The preparation of light oils and motor fuels by the catalytic hydrogenation of coal, fuel oil, and petroleum residues has become the most important modern development in the petroleum industry. In 1913 Bergius (55) started work on the high-pressure hydrogenation of coal. In the original process hydrogen was allowed to react with a mixture of pulverised soft coal and heavy mineral oil (the latter was used to prevent coking) at a temperature of about 450° and a hydrogen pressure of several hundred atmospheres. The mechanism of the reaction involves preliminary cracking with subsequent hydrogenation. It was found that as much as 85 per cent. of some soft coals could be converted to liquid products. Peat, wood, pitch, and heavy oil were found to react similarly.

The original Bergius process was considered by the inventor to be non-catalytic, although he recommended the addition of 5 per cent. iron oxide to eliminate sulphur from the petroleum. The I. G. Farbenindustrie has undertaken an intensive investigation of this reaction, paying particular attention to operating conditions and the effects of added catalysts. Tropsch (56) has stated that these investigations have shown that in hydrogenating crude brown coal it is possible to obtain either gasoline, kerosene, gas oil, or lubricating oils by varying the hydrogen pressure, velocity of flow, and the catalyst used. The reaction can be so controlled that either aliphatic or aromatic hydrocarbons may be obtained, either low-boiling or high-boiling, or a mixture of both. By controlling the amount of aliphatic hydrocarbons obtained, anti-knock fuels may be obtained directly. Fischer and Schrader (57) have shown that a mixture of carbon monoxide and steam hydrogenates better than pure hydrogen.

The patent literature is flooded with references to catalysts that may be used in this process. Practically every element has been concerned as well as numerous references to appara-

tus made of special materials. Ordinary hydrogenating catalysts are not very efficient because of the ease with which they are poisoned. Graham and Skinner (58) have found that ammonium molybdate is an excellent catalyst; nickel and iron oxide are less effective. Hlavica (59) has reported that the rate of hydrogenation is not only increased by true hydrogenating catalysts, such as nickel and cobalt, but also by cracking catalysts, such as aluminium, iron, or zinc chlorides. Oxides of zinc, nickel, cobalt, and copper are more effective than iron. Varga (60) states that iron oxide is a good catalyst. Hugel (61) recommends the use of alkali and alkaline earth metals, such catalysts being immune to the usual poisons and comparable in activity to nickel. Dunstan (62) reports that molybdate oxide and pentamine cobalt chloride act as energetic hydrogenation catalysts; tungstic oxide, sodium amide, barium dioxide, and zinc oxide are not effective. According to Reichenbach (63) certain sulphides, such as those of iron and cobalt, as well as a number of other materials and mixtures, are efficient catalysts.

#### Conversion of Inferior Petroleum Fractions

The Standard Oil Co. of New Jersey has recently acquired the American rights to this process and in co-operation with the I. G. Farbenindustrie has undertaken an extensive research on the hydrogenation of fuel oil (64). Catalysts have been developed for the process which are not only resistant to sulphur compounds and other poisons usually found in petroleum, but are actually able to eliminate the sulphur present. They have been able to convert heavy, high-sulphur, aliphatic crude oils, and refinery residues into gasoline and valuable low-boiling materials. In fact, it is possible to obtain a volumetric yield of gasoline and gas oil greater than 100 per cent. Another important development is the conversion of inferior petroleum fractions to high-grade, valuable ones. This process can be so controlled as to produce any material that the market may demand and seems, at last, to have been placed upon a commercial basis.

Vapour phase oxidation reactions are exceedingly difficult to control and it is only by careful regulation of operating conditions that materials other than the final combustion products, carbon dioxide and water, are obtained. The value of these reactions depends entirely on the intermediate compounds isolated. Catalysts are the most effective means of attaining this end. Much work has been done on the catalytic oxidation of methane to formaldehyde. It is said that large quantities of methyl alcohol are produced commercially by the catalytic oxidation of natural gas (65). The yields of valuable products are, however, extremely small and, as far as formaldehyde is concerned, there is little likelihood of this process competing with that in which the aldehyde is obtained by the catalytic oxidation of methanol. Several oxidation reactions that have developed into ones of great commercial importance are interesting enough to merit discussion; these involve the use of vanadium pentoxide—the most valuable vapour-phase oxidation catalyst that has even been developed. Walter (66) was the first to report the use of this material as an oxidation catalyst.

#### Maleic Acid from Benzene

The control of the oxidation of benzene to maleic acid represents a notable achievement. Weiss and Downs (67) have been the foremost investigators of this reaction. The oxidation of benzene involves three distinct steps; quinone is first formed, then maleic anhydride, and finally the latter is completely oxidized to carbon dioxide and water. By properly controlling the reaction, *i.e.*, by employing a suitable catalyst, regulating the temperature and other operating conditions, a 40 per cent. yield of maleic acid may be obtained. The anhydride is hydrated in the process and recovered as maleic acid. Probably the bulk of the maleic acid manufactured is converted to malic acid, a material which may readily be substituted for citric acid as an acidulant in foodstuffs. Of course, the oxidation of quinone to maleic anhydride can very easily be performed. Vanadium pentoxide is the most active catalyst that has been found, although molybdenum trioxide is very efficient. The use of various other oxides has been patented, although their activity is not comparable with the two mentioned. It is very probable that the mechanism of the reaction involves the alternate oxidation and reduction of the catalyst.

In the vapour phase oxidation of naphthalene, naphthoquinone, maleic anhydride and acid, benzoic acid, phthalic anhydride and acid, and complete combustion products are obtained (68). Phthalic anhydride is the major product under proper conditions a yield of this material better than 90 per cent. may be obtained with vanadium pentoxide (69). Vanadium pentoxide is a surprisingly sturdy catalyst for this reaction and in commercial operations such analyses have performed month after month of continuous service with no decrease in efficiency. Even crude naphthalene has been employed with no apparent ill effects.

#### Oxidation of Anthracene

Kusama (70) has reported that acidic oxides are the best promoters for vanadium pentoxide in the oxidation of naphthalene. Maxted (71) has found that tin vanadate is just as effective as vanadium pentoxide at a considerably lower temperature. Bismuth vanadate is comparable in activity with the pentoxide.

Vanadium pentoxide is also the best catalyst for the oxidation of anthracene to anthraquinone (72). Senseman and Nelson (73) have obtained yields of 81 per cent., using anthracene and air at 410-25° in the presence of vanadium pentoxide catalyst. Their experiments also indicate that in this reaction the hydrocarbon is oxidized by the pentoxide and the resulting lower oxide is reoxidized by the free oxygen present. An interesting application of the vanadium pentoxide catalyst is described by Jaeger (74). There is a great demand for pure anthraquinone for the preparation of vat dyes. It has been exceedingly difficult to obtain a pure product from crude anthracene in reasonable yields. By selective catalytic oxidation at 360-440°, using certain metallic oxides admixed with alkaline earths, heterocyclic impurities, paraffin impurities, and aliphatic compounds, including phenanthrene, may be burned out, yielding anthracene of high purity. The purified material may be oxidized to anthraquinone in the same operation using a vanadium pentoxide catalyst.

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## Thermal Insulation and Insulating Materials

By PROTEUS

IN the chemical industry, no less than in nearly all industrial processes, expenditure on heat constitutes a considerable item in the cost of production, and economies in fuel represent a correspondingly large saving in such costs. There is therefore no chemical branch of the industry which is not directly interested in means of reducing loss of heat by radiation and convection from furnaces, stills, storage tanks, reaction chambers or similar plant. The magnitude of such losses is apparently not always appreciated, since the attention given to thermal insulation is often by no means adequate. While the loss by radiation and convection from boiler plant may reach 10 per cent. of the fuel used, in the case of gas retorts the figure is usually nearer 20 per cent. and, with other types of plant, such as metal heating furnaces and pottery kilns as much as 60-70 per cent. of the heat supplied may be lost. In the case of storage tanks, drying chambers and refrigerating plants, the exact loss is harder to estimate and less noticeable, but is equally important. While a system of thermal insulation is always incorporated in boiler plant and refrigerators, such a practice is not as widely adopted in other types of plant, although by its use the amount of heat lost cold often be reduced to one-third of the usual figure. In particular, modern users of furnaces appear quite content to regard this figure as inevitable, and evince no great desire to take steps to reduce it. It is inconceivable that such a state of affairs is due to the neglect of such a basic consideration as the conservation of heat, especially in view of recent progress in the design of furnaces. The apparent lack of interest is due partly to the fact that manufacturers have not always been in a position to supply a material suitable for particular sets of conditions, especially in the region of high temperature. At the present time, this stricture cannot be said to apply for many manufacturers are now able to offer insulating materials adapted to almost every conceivable set of operating conditions.

### Materials Available

The fact remains, however, that many users are still unaware of the extent to which makers of insulating materials can meet their individual requirements, due to lack of publicity or failure on the part of the manufacturers to furnish complete and accurate data concerning the characteristics and properties of their products. One result has been the creation of an impression that the best materials are of foreign origin, an impression very wide of the mark, for the British Isles contain several sources of excellent material and further supplies are available in different parts of the Empire.

The materials available for heat insulation comprise an extensive range of substances, all characterised by the presence of a relatively high proportion of air space. The value of a substance as a heat insulator depends on its porosity, but its heat insulating properties are largely influenced by the size of the air cells and interstices and their intercommunication. If the pores are large and communicate freely with one another, heat may be transmitted by convection across the cells even at comparatively low temperatures. The primary requirement of a good insulator is therefore the possession of small, non-communicating cells, and this factor determines the nature of the raw materials and the methods of their working up and application.

The resistance offered by an insulator to the passage of heat may be regarded as due to the virtual reduction of the effective cross-section of the material by the presence of the practically non-conducting air-cells. Heat is transmitted across the cells by radiation, however, as well as by conduction through the air, and, as the temperature rises, the quantity radiated increases with great rapidity, until, at 1,000° C., the amount becomes comparable with that conducted through the solid substance. At this temperature the full cross-section of the material becomes operative in heat transmission, the conductivity of the material becomes identical with that of the solid substance forming the pore walls, and the material ceases to act as an insulator. Before this point is reached, however, many materials fail mechani-

cally. Consequently, in selecting an insulating medium, the stability of the material under the conditions of operation is of importance. In some cases, the specific heat, mechanical strength and density may constitute the deciding factors, rather than the thermal conductivity.

### Evaluation of Insulating Materials

In the evaluation of any material, the most important characteristic is its conductivity for heat, since this forms the basis for determining its value as an insulator. The coefficient of conductivity is a function of the temperature and must be determined over the whole range of temperature over which the material is to be used. The relative insulating values of different substances are inversely proportional to the amounts of heat lost from the surface of the material. The conductivity of the material is hence used to determine the temperature attained by the surface, and, from this temperature, the quantity of heat dissipated to the atmosphere by radiation and convection is calculated. The latter is given by the equation

$$H_r + H_c = eE (T_s^4 - T_a^4) + C (T_s - T_a)^3 / 4$$

in which

$H_r$  = heat lost by radiation.

$H_c$  = heat lost by convection.

$T_s$  = Abs. Temperature of surface of insulation.

$T_a$  = Abs. Temperature of atmosphere.

$e$  = emissivity coefficient (0.9 for brickwork and similar materials).

$E$  = Radiation constant ( $17^{-10} \times 10$  for British units).

$C$  = Constant depending on dimensions and shape of hot body (0.3 for vertical plane surfaces and horizontal cylinders of 8 in. or more diameter).

Fig. 1 shows the loss of heat by radiation and convection from surfaces at different temperatures when the atmospheric temperature is 70° F.

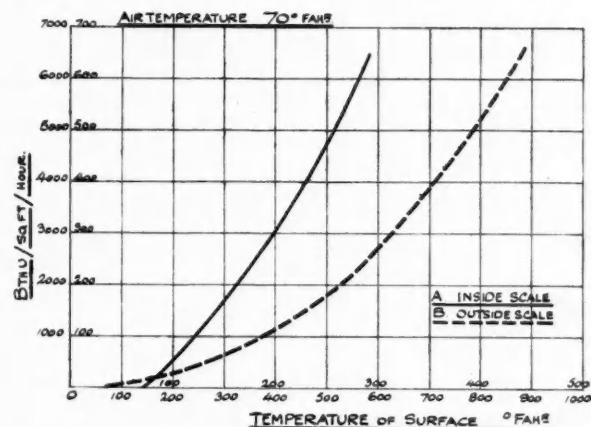


Fig. 1. Heat loss by Radiation and Convection from Cylindrical Surfaces.

This quantity of heat is conducted through the insulator, and is expressed in terms of the conductivity,  $K$ , of the material, the thickness,  $d$ , of the insulation, and the absolute temperatures  $T_f$  and  $T_s$  of the hot and cold faces, respectively, by the equation  $Q = -k(T_f - T_s) / d$ . In the final equation combining these two,  $Q = H_r + H_c$ ,  $T$  is the only unknown quantity, and its calculation for any thickness and type of insulating materials enables a direct comparison of their insulating properties to be made. The terms of the equation, however, are not homogeneous, so that an algebraic solution is not possible, and recourse must be had to a graphical method. Further, the above equations are only strictly valid for parallel plane surfaces of unlimited extent. For surfaces of definite size and shape, the mathematical expressions are much more complicated and can only be solved for certain special cases. In consequence, the relative

values of different types of insulators are generally determined by the direct measurement of the heat lost from an internally-heated body fashioned from the material.

### Testing Methods

A suitable method of testing insulating materials is described in detail in "Engineering," 1927, Vol. 123, No. 3, p. 182. An electrical heater is employed, surrounded by the material to be examined, and the heat loss is calculated from the consumption of electrical energy. By this means, insulating materials of various kinds can be compared directly, and, from observations of the temperatures during

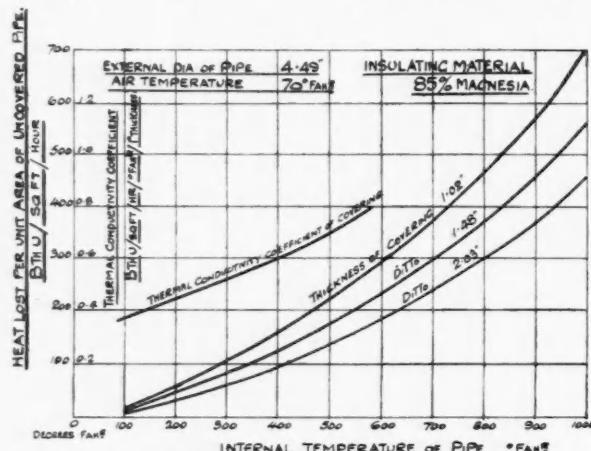


Fig. 2. Heat loss from Steam Pipes with different thicknesses of insulation and at different internal temperatures.

the experiments, the thermal conductivity of the materials can be calculated. In Fig. 2 are shown the curves obtained at the National Physical Laboratory in tests on a plastic insulating composition, consisting of a mixture of 85 per cent. magnesia and 15 per cent. asbestos fibre, when used to cover a 4 in. steam pipe. The heat loss is shown when using three different thicknesses of composition.

The efficiency of insulation is seen to depend on the temperature of the heated surface. This determines the temperature of the external surface, which, in turn, governs the quantity of heat emitted. It is also apparent that the reduction in heat loss is not proportional to the thickness of the covering. The relative values of coverings 1 in. and 2 in. in thickness at different temperatures are shown in the following table:

| Temperature.<br>°F. | Heat lost per Unit Area of<br>Uncovered Pipe. |                  | Increase in<br>Efficiency.<br>Per cent. |
|---------------------|---|------------------|---|
|                     | 1 in. thickness.<br>B.Th.U. per hr.           | 2 in. thickness. |   |
| 200                 | 54.5  | 33.3             | 61.0                                    |
| 400                 | 158.5   | 97.7             | 61.6                                    |
| 600                 | 292.0   | 184.4            | 63.2                                    |
| 800                 | 466.0   | 301.5            | 64.4                                    |
| 1,000               | 696.0   | 459.4            | 65.5                                    |

### Shrinkage and Fusion Point

In addition to the determination of the thermal conductivity, other properties of the material may require examination, according to the use to which it is to be put. In the region of high temperatures, where the material is made into bricks for the lining of furnaces, the shrinkage at temperatures of 900° C., 1,000° C. and 1,100° C. (1,652°, 1,832° and 1,912° F.), should be ascertained, as well as the fusion point, crushing strength when cold, and temperature of subsidence under a load of 10 lb. per sq. in. Diatomaceous bricks should have a cold crushing strength of more than 300 lb. per sq. in., and a thickness of 4 in. should reduce the temperature from 800° C. (1,472° F.), to less than 200° C. (392° F.). Insulating brick having also some refractory properties, though less efficient as insulators, are often used in furnace design, where they have to bear a portion of the load, and, for these, the "under load" refractories is important. For medium and low temperature insulation the specific heat is of importance where heating is inter-

mittent, while the density is a primary consideration where the additional weight is required to be the minimum, as in self-supporting pipe-lines and insulated vans.

Insulating media may be conveniently classified under four heads, depending upon the range of temperature over which they are used, *viz.*, low temperatures, up to 200° F., medium temperatures, from 200°-700° F., moderately high temperatures, from 700° F.-1,000° F. and high temperatures above 1,000° F. It will be found that each group demands special properties in insulators, and, though some materials may find application under more than one head, no one insulator so far developed is applicable over the whole range. The property of a number of materials are shown in Fig. 3.

### The Use of Cork

Included in the first category is the insulation of refrigerating systems, storage tanks, tank wagons, vats, etc. Within this temperature range, cork is probably the most extensively employed insulator. Besides being of extremely low heat conductivity, its density is also low and it is capable of being made into boards and modelled into any special shape that may be required for a particular purpose. The most efficient insulator is prepared by baking the granulated cork, when the natural resins in the cork act as a binding material and consolidate the mass. Cork insulation is also made by utilising gum or organic binding material without baking, but material so made has a higher thermal conductivity and is liable to disintegrate. Wood of various kinds are also used, as well as wood pulp and straw-boards, but these materials are much less efficient than cork. Slag wool and glass silk, while being of low conductivity and very permanent in themselves, suffer from the disadvantage that they tend to lose their fibrous structure as a result of continued vibration. Latterly, material with rubber as their basis have come into use, and these appear to behave very satisfactorily, although their thermal conductivity and density are rather higher than in the case of cork. The most recent development is the use of crumpled aluminium foil, which, on account of its extremely low density, is finding extensive application in the insulation of vans for the transport of frozen and perishable foods. Aluminium foil insulation is also applicable to surfaces of temperatures up to 900° F. Fig. 4 shows the effect of lagging surfaces at different temperatures with aluminium.

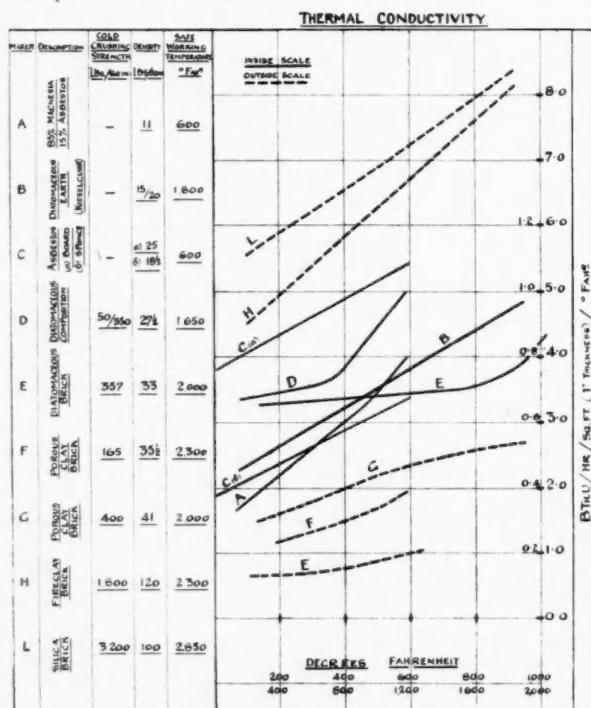


Fig. 3. Properties of Insulating and Refractory Materials.

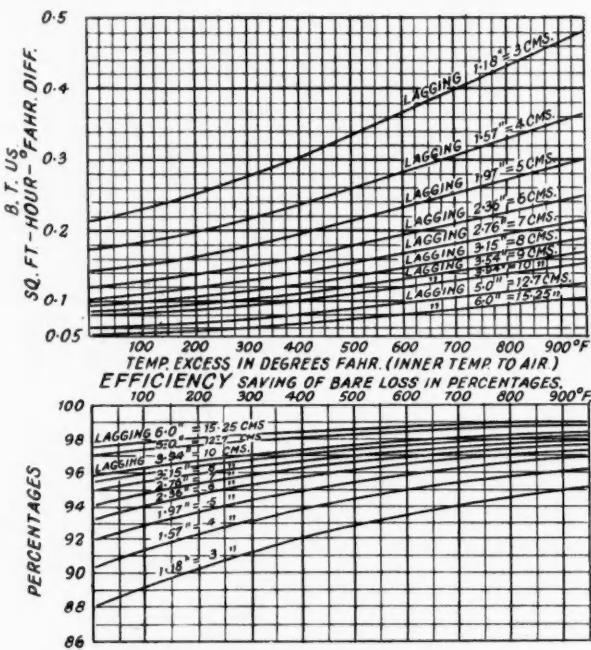


Fig. 4. Heat loss from flat surfaces insulated with Aluminium Foil.  
Air temperature 70° F.

### Other Insulating Materials

For the insulation of surfaces at temperatures between 200° F. and 700° F., such as boilers, steam pipes, drying plants, etc., various plastic and fibrous materials are available, in addition to aluminium foil. The effect of lagging with aluminium foil is shown in Fig. 4. Magnesium carbonate or oxide and asbestos form the basis of the majority of such compositions, a mixture of 85 per cent. of magnesia with 15 per cent. of asbestos being very widely used. Asbestos fibre made up into the form of mattresses, rope or mill-board is often employed, especially where periodical removal of the lagging is necessary. Although denser and of lower insulating efficiency than magnesia compositions, asbestos in this form avoids the expense of continual renewal of the composition, and it is noteworthy that it has recently been found possible to prepare asbestos mattresses of indefinite permanency and with an insulating efficiency equal to, if not superior to, that of magnesia lagging. Slag wool and glass silk are also useful within this range of temperature, and, like some forms of infusorial earth, are frequently incorporated in various types of insulating compounds.

The third group of materials comprises chiefly plastic mixtures which are applied in the wet state to superheated steam pipes, Diesel engine exhausts, sulphuric acid reaction towers, etc. Magnesium silicate or asbestos are the principal constituents, the compound being usually a mixture of magnesia and asbestos or lime and a silicate with asbestos. Such compositions are poorer insulators than 85 per cent. magnesia, but some sacrifice of efficiency has to be made to secure a more stable material at the higher temperature.

### Conservatism of Heat at High Temperatures

The scope for the conservatism of heat at high temperatures is much wider, and the need more obvious than in the other groups considered, so that the range of materials is correspondingly more varied. Three classes of material may be considered: (1) Powdered and fibrous materials suitable for temperatures up to 800° C. (1,472° F.); (2) Moulded materials, with a basis of diatomaceous earth, suitable for temperatures up to 850° C. (1,562° F.); (3) Moulded refractory materials of highly porous structure suitable for use at temperatures up to 1,300° C. (2,372° F.) and over. In the last case, some degree of refractoriness is demanded, and since such a property is opposed to that of a good insulator, these materials are less efficient as insulators than those dealt with up to the present.

Powdered and fibrous substances are only applicable as fillings for hollow bricks and cavity walls, but they are very efficient when prevented from packing down into the lower part of the cavity. The commonest constituents of powdered insulating materials are crushed diatomaceous bricks and calcined diatomaceous earth, while asbestos and slag wool are the most usual forms of fibrous material. With these compounds, care must be taken not to use them in places where the temperature exceeds 800° C. (1,472° F.). Above this temperature fibrous materials lose their texture and break down to a powder, when they lose much of their insulating properties, while powders begin to fuse and sinter together, unless previously calcined at 1,000° C. (1,832° F.), with a resulting increase in thermal conductivity.

For temperatures up to 850° C. (1,562° F.) moulded products are employed which are fashioned from diatomaceous earth or burnt magnesia into special shapes, pipe

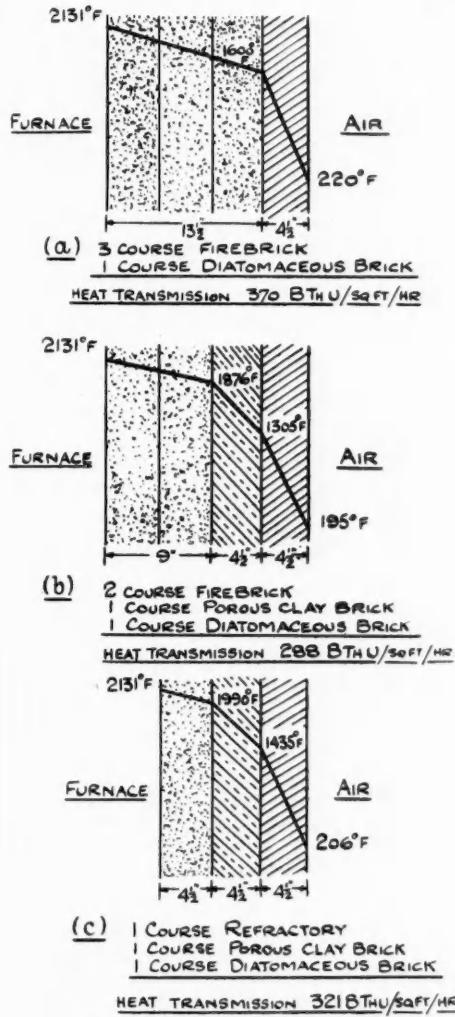


Fig. 5. Three Examples of Furnace Wall.

coverings or bricks. The raw material is silica of a particularly low bulk density, and consists of the siliceous skeletons of minute uni-cellular organisms. It occurs in many parts of the world and is variously known as diatomaceous earth, kieselguler or infusorial earth, and several deposits are worked in the British Isles. With diatomaceous bricks, a temperature of 850° C. (1,562° F.) must not be exceeded, since, between 850° C. (1,562° F.) and 1,000° C. (1,832° F.) a contraction may take place, varying from 3 to 15 per cent. The process of manufacture is similar to that of ordinary firebrick, a portion of combustible matter being incorporated

to impart additional lightness to the texture, but the temperature of burning is much lower. The conductivity of such bricks is only about one-tenth of that of firebrick, but they have little mechanical strength, and therefore cannot sustain any appreciable load and their resistance to abrasion is small.

### A New Development

For insulation at the highest temperatures, there has recently been developed a type of refractory insulating brick which, to a limited extent, combines the properties of both fire-brick and diatomaceous bricks. They are made by incorporating a proportion of carbonaceous matter in the fireclay during the moulding of the brick. On firing, this burns away, giving a highly porous brick, differing from a diatomaceous brick in the size and shape of the pores. Whereas with a diatomaceous brick the pores are microscopic and individually distinct, with refractory insulating bricks the cells are much larger and communicate with one another.

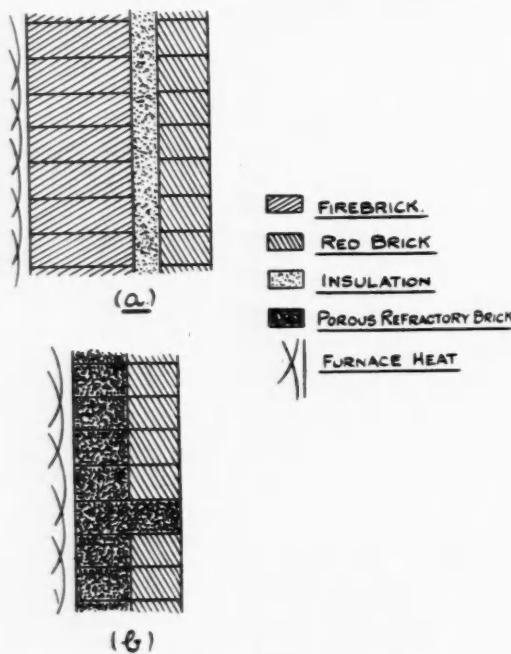


Fig. 6. Two Walls of equal Thermal Conductivity but of different thickness.

In consequence, the conductivity of the latter is greater than that of the former, although still only one quarter of that of ordinary firebrick. At the same time, the higher porosity entails a lower mechanical strength than that of firebrick, but refractory insulating bricks are capable of carrying moderate loads up to  $1,300^{\circ}$  C. ( $2,372^{\circ}$  F.) and this temperature may be exceeded in the absence of load. Such bricks are specially valuable where a minimum thickness of wall is required. They can often be used in the place of refractory bricks, and, since their lower conductivity gives rise to a greater fall of temperature, it is possible to use diatomaceous bricks in direct contact with them. In Fig. 5 are shown three examples of furnace walls, which demonstrate the possibilities of porous clay bricks in reducing the thickness necessary. Although (b) gives the lowest heat loss, (c) is the most economical to use owing to the smaller amount of material required. A further example, supplied by another manufacturer of insulating material, is given in Fig. 6. The wall (a) consists of 9 in. of firebrick separated by a layer of insulating brick,  $2\frac{1}{4}$  in. thick, from an outer wall of common brick,  $4\frac{1}{2}$  in. thick, while (b) consists of one course of porous fireclay brick and one of common brick, each  $4\frac{1}{2}$  in. thick. Both walls permit the same heat loss, but their weights are in the ratio of 2.6 to 1, the costs are 1.5 to 1 and the space occupied 1.75 to 1.

The question of insulation is closely bound up with that of cost of application and saving effected. While in the case of refrigerating plant, coolers, boilers, steam pipes, etc., insulation is essential, its application to other plant such as reaction chambers and furnaces needs careful consideration. In the former case it must be incorporated in the design of the plant and there is little to choose between the various types of material available. In the latter case, however, insulation usually represents an additional feature, so that the choice of the most suitable material is a matter of importance.

Various practical considerations must not be overlooked in connection with insulation, especially of surfaces at high temperatures. The introduction of an insulating layer considerably alters the temperature conditions at the surfaces of separation of the furnace wall and insulating layer. For example, if a wall of  $13\frac{1}{2}$  in. of firebrick is covered with a layer of 9 in. of common brick, with a furnace temperature of  $1,350^{\circ}$  C. ( $2,462^{\circ}$  F.), the surface of separation would have a temperature of  $670^{\circ}$  C. ( $1,238^{\circ}$  F.) and the outer face a temperature of  $95^{\circ}$  C. ( $209^{\circ}$  F.). If a layer of 4 in. insulating brick and  $4\frac{1}{2}$  in. of common brick were substituted for the 9 in. of common brick, the outer face of the firebrick wall would rise to  $1,070^{\circ}$  C. ( $1,958^{\circ}$  F.), the face between the insulating brick and common brick would reach a temperature of  $290^{\circ}$  C. ( $558^{\circ}$  F.) and the exterior surface would fall to  $50^{\circ}$  C. ( $122^{\circ}$  F.). The refractory properties of the material constituting the furnace lining should therefore receive primary consideration. Again, insulation is definitely undesirable in certain cases, as, for instance, in a steel-melting furnace, where the temperature may reach  $1,700^{\circ}$  C. ( $3,092^{\circ}$  F.). Silica melts at this temperature, so that, unless the firebrick employed is of high conductivity and can dissipate the heat sufficiently rapidly, collapse of the furnace will ensue.

### Jointing Materials

An important point to bear in mind when using non-plastic, discontinuous insulation, in the form of slabs or bricks, is the nature of the jointing material. At low and medium temperatures, where plastic compositions or very large slabs can be used, such a consideration is of relatively small importance. But at high temperatures, when the insulation generally takes the form of bricks, the area of the joints constitute a considerable fraction of the total surface, and it is necessary to employ a cement of insulating properties equal to those of the bricks. To this end, diatomaceous clay cement should be used for diatomaceous bricks, while porous clay bricks require to be laid in a mixture of the same clay with crushed brick.

A final work may be added on the protection of the surface of insulating material. Except in the case of furnaces, where the insulation is frequently incorporated in the structure of the furnace, the insulating layer forms the outermost surface. Consequently, it is necessary to protect it from atmospheric effects and mechanical damage. Low temperature insulation always requires protection from the action of water, which is readily absorbed by felt, cork, wood and magnesia compositions and destroys their insulating properties, leading in many cases to complete disintegration of the covering. Such surfaces are generally covered with a thin layer of waterproof cement, which forms a hard surface capable of withstanding mechanical abrasion. Plastic compositions are frequently covered with thin sheet metal or stout canvas cloth which is then coated with bitumen, black varnish or aluminium paint. The last has the additional advantage to recommend it, that the extremely low emissivity coefficient of aluminium still further reduces the loss of heat by radiation.

Insulating bricks, both of the diatomaceous type and the porous clay type, are somewhat fragile and require careful handling in transport. Where space permits, such bricks are usually protected by a course of common bricks, but this is not always possible, and recourse must be had to coating of hard cement, or a sheathing of thin metal such as charcoal plate.

THE market in Columbia for creosote oil, zinc chloride, and other wood preservatives is at present undeveloped. Although there is a considerable need for wood preservative treatment of construction timbers, telegraph poles, piling, etc., due to the many agencies which attack lumber there is a very small consumption of wood preserving chemicals.

## Chemical Industry in the Soviet Union

### Extensive Production of Acids and Fertilisers Anticipated

CONSIDERABLE development is taking place in the Soviet chemical industry in accordance with estimates under the Five-Year Plan, and it is now predicted that the U.S.S.R. will assume shortly one of the most important positions in the world in regard to chemical production. The necessity for an increase in output to satisfy the ever-growing requirements of industry and agriculture in the Soviet Union is all the greater, considering that the chemical industry was amongst the least developed of all in pre-war Russia. Many branches of it, including the manufacture of fertilisers and dyestuffs, were practically unknown. Other branches existed, but with an insufficient level of production, which necessitated considerable imports from abroad. This insufficiency proved a real difficulty as soon as the present economic expansion was started and a determined effort was therefore made to improve matters by increased production.

#### The Berezniky Combine

Among the largest chemical works in the Soviet Union at present under construction is the Berezniky Chemical Combine, in the Ural Region, on the Kama River, which is a tributary to the Volga, thirty kilometres south of Solikamsk. This combine is being constructed in two sections, the first of which is being started during this month. The value of the annual output of the first section is to be 45 million roubles based on 1926-27 prices, and that of the whole combine 100 million roubles. The cost of construction of the first section is more than 100 million roubles, about 60 per cent. of which will be expended on the equipment and installation.

The first section of the Berezniky Combine will consist of ten chemical works, each comprising a number of departments. There are in addition a number of large auxiliary enterprises including a steam and electric power plant, a water pumping station and engineering works which were completed in the autumn of 1931. The electric power station has a capacity of 80,000 kilowatts. Steam production is 600 tons per hour, five boilers being installed to provide steam at a pressure of 60 atmospheres, and the pumping plant is rated at 5,700,000 gallons of water per hour. The combine is ideally located as regards raw materials and fuel. It is in close proximity to rich deposits of sodium and magnesium salts, limestone, pyrites (as source of sulphur), phosphate rock, etc. About 19 miles to the north are situated the potassium deposits of Solikamsk, and 56 miles to the south are the Kiselovo coal mines, which will provide cheap fuel and a large quantity of waste products for the chemical industry. The potassium deposits of Solikamsk, which were discovered by Soviet geologists about four years ago, are believed to be the largest potash deposits in the world, and are now being intensively mined. Although situated at a considerable distance from the agricultural districts, which will form the main consumers of the products of the Berezniky Combine, this difficulty is partly eliminated by excellent water transportation facilities during the summer months on the Kama and Volga rivers. Railway facilities are at present inadequate, but plans are being considered for improving the position by the construction of new lines.

#### The Voskresensky Combine

Although some of the machinery and equipment has been imported, Soviet factories are providing a large proportion, even in cases where such machinery was not previously manufactured in the Soviet Union. The designs for the ammonia plant were drawn up by the Nitrogen Engineering Corporation of New York. The same firm is also advising on construction of other chemical works features. The combine is scheduled to provide Soviet agriculture during 1932 with 80,000 tons of concentrated fertilisers. It will also manufacture potassium salts, which are now imported as an aid in raising the crops of flax and potatoes; also sodium salts, of which the soap and glass industries have experienced a shortage in past years.

During March the sulphuric acid factory of the Voskresensky Chemical combine, near Moscow, was started up.

This is claimed to be the largest factory in the world for the production of sulphuric acid and its normal output capacity will be 160,000 tons per annum, capable of an increase to 240,000 tons by intensified production. The Voskresensky combine consists of a number of other works, in addition to the sulphuric acid factory, the principal ones being a phosphate mill, with an output capacity of 200,000 tons of ore; a superphosphate works of 100,000 tons capacity, started up in 1931; the Lopatinsk phosphate mines of 200,000 tons capacity, which will start work on May 1; and the Perkhurov lime mine.

Amongst the large chemical concerns now being constructed or finished, the Voskresensky factory occupies premier place for the fertiliser industry, particularly in its treatment of phosphorites. One million tons of phosphatic fertiliser and not less than 145,000 tons of pure phosphoric acid are the output designed for this factory. It is being built on the banks of the River Moscva, amongst the phosphoric deposits, and on the Moscow-Kazan railway system, thus assuring cheap raw material and cheap transport. The plant includes a grinding mill of 200,000 tons capacity, for phosphoric meal, the cheapest and simplest fertiliser, a superphosphate factory of 110,000 to 120,000 tons capacity, two precipitating plants of 80,000 tons capacity, a double-superphosphate factory of 100,000 tons capacity per annum, and two tower sulphuric acid plant of 160,000 tons capacity.

The precipitation and double-superphosphate plants are the first of such to be installed in Russia. The production of these factories is mostly concentrated fertiliser, containing precipitating plants of 80,000 tons capacity, a double-super-soluble phosphoric acid two and a-half to three times stronger than the usual standard, thus facilitating the freight problem. The sulphuric acid factory is calculated, as a unit, to be the record in size in Russia or Western Europe. Its annual production under pressure will be 280,000 tons of acid. It has been designed with the aid of German firms, and is in all respects as to equipment absolutely up-to-date, whilst the different operations in the factory movement of goods, etc., will be entirely mechanised, and the power entirely electricity.

#### Chemical Industry in Pre-War Russia

The chemical industry of pre-war Russia was at such a low level of development as to be the least in world importance in the production of chemicals. There were numerous chemical enterprises of a small nature, mostly making pharmaceutical goods, perfumes, matches, rubber articles etc., which products are not now included in the basic chemical industry of the Soviet Union. The total output of the chemical industry of pre-war Russia in 1913 was 336 million roubles.

The rapid growth of industrialism in the Soviet Union and the reconstruction of agriculture necessitated a vigorous development of the chemical industry, which has proceeded at a pace to give it one of the foremost places in world production of chemicals. In 1928-29, the gross output of the state chemical industry of the U.S.S.R. was 884 million roubles. By 1929-30 the output was valued at 1,126 million roubles, and this year the estimated production is 1,500 million roubles. In 1931 the output of superphosphates in the U.S.S.R. exceeded that of Great Britain and Belgium. The estimated production of superphosphates in 1932 is 850,000 tons, which will make the Soviet chemical industry the third in world importance, being preceded only by that of the United States and France. The output of sulphuric acid is also increasing rapidly, and is estimated this year to reach 830,000 tons, which is 100 per cent. more than the production in 1931. Whereas in 1931 the Soviet Union was the sixth in world importance in the production of sulphuric acid, this year it will be third, coming after France and Germany.

THE exploration for phosphates in the vicinity of Buitenzorg, Java, has indicated the presence of about 20,000 to 30,000 tons of material with an analysis of between 26 and 27 per cent. P<sub>2</sub>O<sub>5</sub>. It is doubtful that further exploitation of the project will be undertaken at present, owing to the financial situation and the existing low prices on imported fertilisers.

## Iron and Steel Institute

### First Joint Meeting with Institute of Metals

THE first joint meeting of the Iron and Steel Institute and the Institute of Metals will be held in London, September, 12-15. The business sessions for the reading of papers will be held in the halls of the Institution of Civil Engineers and of the Institution of Mechanical Engineers. The opening session will be held on Monday evening, September 12, when Dr. H. J. Gough, of the National Physical Laboratory, will deliver the annual autumn lecture of the Institute of Metals on "Corrosion Fatigue in Metals." On Tuesday morning there will be a joint session at the Institution of Civil Engineers, when five papers of interest to members of both Institutes will be presented for discussion. In the afternoon separate sessions will be held, papers of the Institute of Metals being discussed at the Institution of Mechanical Engineers, and those of the Iron and Steel Institute at the Institution of Civil Engineers.

On Tuesday evening a conversazione will be given at the Science Museum, South Kensington, the guests being received by Sir Charles Wright, the president of the Iron and Steel Institute, and Sir Henry Fowler, the president of the Institute of Metals. On Wednesday morning, September 14, final separate sessions of the two Institutes will be held. Altogether it is expected that 14 Iron and Steel Institute papers and 17 Institute of Metals papers will be presented at the various sessions. The remainder of the meeting will be devoted to visits to works and institutions in the neighbourhood of London. On Wednesday, September 14, members will have an opportunity of visiting either the National Physical Laboratory; the General Electric Co.'s Research Laboratories at Wembley; or the Acton Refinery of the Mond Nickel Co. On Wednesday evening an informal dinner-dance will take place at the Piccadilly Restaurant. Thursday, September 15, will be devoted to an all-day excursion to the Dagenham works of the Ford Motor Co.

## Water De-Oiling Technology

### Use of the Active Carbon Process

THE small quantities of oil normally present in condenser water which is fed back into the boilers is often the cause of serious mischief. A layer of oil of not more than 0.5 mm. thickness in contact with the heated boiler wall is equivalent in heat-insulating power to a 5 mm. thickness of boiler scale. Another unpleasant feature of oily feed water is the tendency to agglomerate with particles of suspended mud to form spherulets capable of storing up heat with subsequent explosive consequences. There is one well-authenticated case where these oil-mud spherulets reached a diameter of no less than 10 mm. Surprisingly little oil, again, is required to ruin the finish of textile materials during washing or dyeing. Similarly, a trace of oil in water intended for ice or ice-cream manufacture is fatal to the taste of the product.

### Processes Available for De-Oiling

If the enormous number of water de-oiling processes which have been proposed in the course of the century, comparatively few have been adopted on an industrial scale, and these may be classified under three main headings.

In *mechanical de-oiling* the water is slowly driven in a zigzag direction through depositing tanks, the separation of oil at the upper surface being usually hastened by aeration or pressure; in spite of its simplicity and cheapness, however, this system has definite limitations on account of its inability to eliminate any considerable proportion of the emulsified or dissolved oil. *Chemical methods* for removal of oil are based upon the oil-adsorption capacity of certain inorganic gels—notably aluminium hydroxide—formed *in situ*, and are of unquestioned efficiency, notwithstanding the inconvenience and expense of the chemicals employed; the aluminium hydroxide is generally produced in the water by reaction between aluminium sulphate and soda. For *electrolytic methods*, there is likewise general agreement as to the efficiency of separation whereby the oil-in-water emulsion is broken up by contact with iron electrodes, the agglomerating oil particles being adsorbed by (or co-precipi-

tated with) the basic iron salts which are simultaneously formed; water with a residual oil content of less than 1 gram per cubic metre is said to be obtainable with the aid of a current strength of 0.2 kilowatts per cubic metre.

### Tests on De-Oiling Condenser Water

Still another system which has been applied with notable success of recent years is that based upon the adsorption of oil, benzole, etc., by activated carbon. In this case efficient oil extraction is dependent upon the degree of activation of the carbon. In the issue of the "Chemiker-Zeitung," May 10, 1932, page 630, M. Jaenicker details experiments to illustrate the value of activated carbon as an oil-remover for potable water and sewage. The condenser water from a reciprocating steam engine with an oil content of 5.6 grams per cubic metre was first passed through a standard type of mechanical oil-separator—which reduced the oil content to 4 grams—and then forced upwards through a 100 cm. layer of a specially-prepared active carbon made by the Carbo-Norit-Union, Frankfort-on-Main. The oil content was thereby reduced to 0.8 gram, which is a highly creditable performance, when it is borne in mind that a residual oil content of less than 1 gram per cubic metre is not found in practice to possess serious drawbacks. After filtration in the manner described, the condenser water was perfectly clear and colourless. A slight increase in the ash content of the order of 1 mg. per litre, was traced to the presence of soluble mineral impurities in the activated carbon, but still purer grades of carbon are being made available for processes which call for a completely residue-free water.

## Coconut Oil Industry

### New Factory Operating in Jamaica

DURING July the new edible oil and copra factory erected at Kingston by the Jamaica Coconut Producers' Association started operation, and the oil will soon be placed on the local market. The new co-operative has come into being through the passing in 1931 of a law in aid of the coconut industry, to promote and encourage the local manufacture of edible oils. This law provides that the governor appoints a board to be called the "Coconut Products Board," with such powers and duties as are necessary. Furthermore, powers are given to prevent the importation of edible oils except under license, and to control the exportation of copra and coconut oil under license. This law also gives authority to the Governor to fix the maximum retail prices of the various grades of edible oils in Jamaica and to impose a duty on edible oil at such time as he shall see fit. It lays down the conditions under which edible oil is to be manufactured and gives authority for the imposition of an excise duty of 9d. per gal. It is estimated that the association will absorb from its members about one-third of Jamaica's production of coconuts and that the output will entirely take care of local consumption. The manufacture of soap, in connection with the copra and edible oil factory is also under consideration.

As soon as the new coconut-oil factory is put in operation, the increased duties on edible oils will come into effect. The preferential rate on edible oils will be 4s. 9d. per gal. and the general rate will be 6s. 9d.

## Russian Solvents Industry

### Anticipated Output for 1932

DIACETONE alcohol, methyl acetate, acetone, ethyl acetate and amyl acetate are the principal nitrocellulose solvents at present being manufactured in Soviet Russia. A total production of about 6,700 tons had been planned for the current year, but it is expected that the actual output will fall short of this figure by about 30 per cent. According to S. Wolkowyski ("Moscow Journal of Chemical Industry"), other solvents which it is intended to manufacture include ethyl glycol, normal and isopropyl acetate, glycol monacetate, and butyl glycol. With regard to the future orientation of the solvents industry, there is every indication of the wood carbonisation industry receding into the background and being largely superseded by the newer fermentation processes and petroleum conversion methods.

## Weighing in the Chemical Industry

### Two Useful Machines

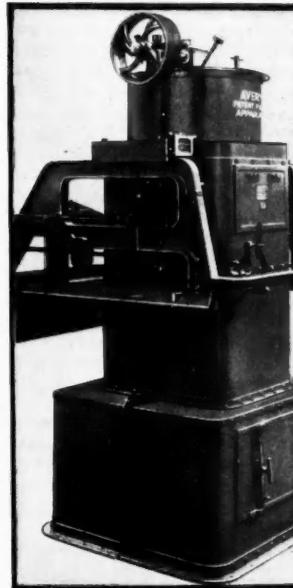
DEVELOPMENTS in the design and utility of weighing machines are very apt to pass unnoticed by works where chemicals are made or used in large quantities. There is, for instance, a decided tendency to regard the ordinary platform weigher as being capable of fulfilling all immediate needs, even when special exactitude is desirable in preparing the charges for manufacturing process. In consequence, the manufacturer often suffers minor inconvenience or unnecessary expenditure of labour.

One of the most useful scales for general use in the chemical industry has been designed by W. and T. Avery, Ltd., for the particular purpose of weighing or check-weighing chemicals which are put up in sacks (or other containers) to a pre-determined weight set on a steelyard inside a lock-up cabinet. The variation, if any, in the weight of a sack placed on the platform is indicated on a clearly marked chart, graduated light and heavy, from a central zero which represents correct weight. Positive visible indication is given to the operator of the amount in excess or deficiency and it is a simple matter for a little material to be added or taken away by means of a small handscoop. This machine (Avery A771) has a capacity of 3 cwt. or its metric equivalent. The chart is graduated up to 5 lb. or equivalent, both light and heavy, with divisions of 2 oz. and the platform is fitted with a back-rail against which sacks can be rested.

Every chemical plant also has a use for automatic chemical weighers of another type illustrated (Avery 68). This particular machine is fully enclosed and is suitable for handling such material as ammonium nitrate, nitro-chalk, soda ash, etc. All dust generated in the weighing operation is enclosed with the flow of material, whilst all weighing parts are on the outside of the machine and easily accessible.

There are a number of patterns of Avery automatic weighers, suitable for such materials as rock phosphate, sulphurophosphate, ammonium sulphate and ground sulphur, etc. Such machines offer a direct means to practical economy and plant efficiency, and they are indispensable where unproductive labour must be cut down to a minimum. One of the principal advantages of automatic weighing is that overweight and underweight is avoided; there is no possibility of human error and no skilled labour is necessary. Accuracy combined with speed is, of course, the final test, and the firm of W. and T. Avery, Ltd., seem to have secured

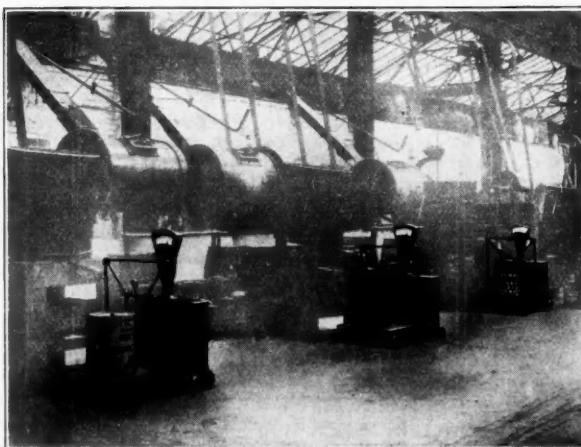
requisite number of weights is placed in this weight box. The chemicals which are being weighed flow by gravity into the weigh hopper. The beam gradually descends, the valve being automatically closed as soon as the correct weight is in the weigh hopper. Immediately this has taken place, the contents of the hopper are discharged through a door at the bottom of the machine, and when discharge is completed, this door is released and closed by means of a



A typical "Avery" Automatic Weigher of the enclosed type.

balance weight. This opens the charging valve and the cycle of operations is repeated.

Allowance is made for the amount of chemical in suspension at the moment the valve is closed. An automatic counter is also fitted to the machine and this records the number of weighings made. This number, multiplied by the pre-determined weight of each charge, gives the total weight of material passed through the machine, which works by gravity alone and continues to work automatically until the flow of material is cut off by hand. Modern conditions, it may be observed, call for specified methods of handling.



"Avery" Machines engaged in weighing or check-weighing chemicals which are packed in drums or sacks

maximum results in this connection with their range of modern automatic weighers.

The weighing mechanism of these machines consists in principle of a long even arm beam fitted with hardened steel knife edges. At one end of the beam the weigh hopper for holding the charge of chemicals swings freely on knife edges. The weigh hopper is balanced at the other end of the beam by the weight box, also swinging freely on knife edges, and the

## Corrosion Resistivity of Metals

### Research in Leningrad

MANY methods have been devised for following the velocity of metallic corrosion; the loss of weight, the loss of strength, the loss of conductivity in the metal, the evolution of hydrogen, the absorption of oxygen, and even the evolution of heat, have all served as measures of corrosion under different conditions. Recently E. W. Zehnowitzer, of the Institute of Metals, Leningrad, has used conductivity changes in the liquid for the same purpose, introducing into his corrosion vessel two platinum electrodes, connected to a Wheatstone bridge in the familiar manner. His results communicated in a letter to the Editor of "Nature," show that during the corrosion of zinc by sulphuric acid the conductivity of the liquid steadily falls, whilst during attack by distilled water it rises; the conductivity-time curves indicate that an alloy of zinc with 1 per cent. copper reacts much more quickly in the acid than comparatively pure zinc, but more slowly than pure zinc in distilled water. In such cases, the conductivity method may prove of real service. For corrosion by neutral salt solutions, it would probably be less sensitive, whilst the removal of salts through adsorption on zinc hydroxide—a possibility indicated by Dr. Bengough's work—would render interpretation of the results difficult.

## Lancashire Trade Problems

### Unemployment in Chemical Industry

USEFUL information bearing on the depressed state of Lancashire industries situated outside the Merseyside area is embodied in an industrial survey prepared by the University of Manchester at the request of the Board of Trade. This report, which follows on that dealing with the Merseyside area is prepared by the University of Liverpool and recently published by the Board of Trade, is the outcome of a collaboration by a number of investigators connected with the Departments of Economics, Commerce, and Administration at the University. The survey region in this instance comprises all that part of Lancashire and fringe of Cheshire outside the Merseyside area. The report mentions that the industrial centre of gravity in Lancashire is changing. The decline of the cotton industry has reduced the importance of the isolated north-eastern cotton towns, and industry is again tending to concentrate around Manchester and Liverpool. It is pointed out, however, that the country's departure from the gold standard and the fiscal changes are liable to modify the conclusions arrived at as the survey was completed some six or seven months ago.

The south-west corner of the survey region—which includes the towns of Widnes, Runcorn, Warrington, St. Helens, and Earlestown—possesses 40 per cent. of the chemical industry of the region. In this area, the rate of unemployment in chemicals has not fallen below 9 per cent. since 1923; in 1923 it reached 18 per cent.; in 1930, 19 per cent.; and in 1931, 27 per cent. The numbers employed remained almost stationary between 1923 and 1929, and a slight reduction in the numbers of insured male workpeople attached to the industry brought some relief to the unemployment situation. But it is clear from the report that before the 1930 slump there still existed a surplus of more than 10 per cent. of the insured workers. Conditions are not uniform throughout this area, for while employment seems to have been expanding in the chemical industry in Runcorn, the industry has been contracting in Widnes and St. Helens. The position in Widnes gives cause for some anxiety. Unemployment has greatly increased in 1930 and 1931, but some part of this increase appears to have been due not to the world depression but to the continued operation of causes, such as technological and structural changes, which accounted for the contraction of the industry in the earlier years. The employment capacity of the building and engineering trades which are closely associated with chemicals has been adversely affected, and it has been estimated that Widnes now has a surplus of over 3,000 men, of whom less than 1,000 could be absorbed in the existing industries on their present scale, even if they were engaged at full capacity. In these circumstances it is desirable that the surplus should be drained either by the creation of new forms of employment within the Widnes area or by the voluntary movement of male labour into other areas.

## Preparation of Pure Rubber

### Research at the Bureau of Standards

THE preparation of a purified rubber containing 99.5 per cent. of rubber hydrocarbon is described in the "Bureau of Standards J. Res.," 1932 8, p. 751. The rubber is first treated with water in an autoclave at 107 lb. pressure (190° C) for 3 to 4 hours and then washed and digested with boiling water for 4 hours, changing the water every 15 to 30 minutes. This process is carried out in a special type of internal mixer ("India Rubber World," 1929, April, p. 78). Next follows a similar treatment with alcohol containing not more than 5 per cent. and 10 per cent. methanol, and then a few short washings with water. By this means, proteins, resins, sugars, soluble inorganic salts, etc., are removed. The rubber is finally dried by heating in the internal mixer at 110° to 125° C., in a current of nitrogen gas. The dried rubber is dark in colour, and has a density of 0.9088 at 20° C., the coefficient of change in density being 0.000595 per degree between 0° to 61.2° C. The dielectric constant averages 2.37 (at 1,000 cycles per sec. at 25° C.), and the power factor, 0.0015. The conductivity, measured one minute after applying the potential averages  $2.2 \times 10^{-17}$  mho. The electrical properties are apparently independent of the botanical source of the rubber.

## Potassium Sulphate in France

### New Plant at Rouen

THE Rouen plant of the Société Potasse et Engrais Chimiques was constructed for the purpose of converting sylvite into commercially pure potassium sulphate. It is said that this is accomplished by the addition of sulphuric acid to the sylvite on hot turning plates which results in the throwing off of hydrochloric acid gas. This hydrochloric acid gas is then sent through scrubbing towers from which it emerges in the form of aqueous hydrochloric acid, 20° Bé. It was planned to utilise the hydrochloric acid for treatment of bones to produce ossein. It is said, however, this process has not been carried out at the Rouen plant although it is in operation in Belgium at the Limburg plant in which the Société Commerciale des Potasses d'Alsace holds a partial control. At Rouen they are purchasing phosphate rock from Morocco and converting the phosphate into precipitated dicalcium phosphate, which in turn is used with potassium sulphate and ammonium nitrate or sulphate to produce mixed fertilisers.

## Affairs of Artificial Silk Company

### Statutory Meetings Under Liquidation

UNDER the compulsory liquidation of the British-Netherlands Artificial Silk Co., Ltd., the statutory first meetings of the creditors and shareholders were held at London Bankruptcy Buildings, on August 18, before Mr. E. T. A. Phillips, the official receiver. The statement of affairs showed total liabilities £149,618 (ranking £76,410), and assets £1,277, with an estimated deficiency of 498,575 with regard to contributors, the issued capital amounting to £423,020.

The chairman reported that the company was formed in October, 1928, to carry on business as manufacturers of fine-grade artificial silk yarns by means of the viscose process. The directors purchased a freehold factory at Wigton (Cumberland), together with plant, machinery, etc., for £52,500 in cash; also the vendor's interest in the viscose process for £32,500 in cash exchangeable for shares. An agreement was entered into in October, 1929, with the Anglo-Dutch Engineering Co., Ltd., to install machinery and plant capable of producing 30 tons of artificial silk yarn per week. The agreed price of £422,000 was afterwards reduced to £325,000.

On December 6, 1930, the mortgagees, who claimed £13,800, appointed a receiver. Various schemes for reconstruction were considered, but were abandoned when the mortgagees sold the factory and plant by public auction on November 6, 1931. The failure of the company was attributed to inability to obtain working capital after the factory had been equipped. A prospectus was issued in November, 1928, offering 1,400,000 tos. Ordinary and 1,400,000 1s. Deferred shares for public subscription at par, but applications were received for only about 500,000 shares, and the underwriters were unable to meet their liabilities to take up the other shares.

In the opinion of the Official Receiver, the directors ought not to have gone to allotment having regard to the fact that it was found by reason of the poor response by the public that the original programme could not be carried out. Further, the company had been handicapped throughout by lack of capital, the underwriters having failed to take up their obligations.

The liquidation was left in the hands of the Official Receiver and of a committee of inspection.

## Aluminium Production in the United States

ALUMINIUM produced in the United States during 1931 amounted to 177,544,000 lb., valued at £7,460,000, as compared with 229,035,000 lb., valued at £10,200,000, produced in 1930. The principal producing plant was that at Massena, New York, where approximately 46 per cent. of the metal made in the United States was produced. According to the "Engineering and Mining Journal," the domestic price of Alcoa commercial and mill ingot, 99 and 98 per cent., was 23.3 cents a pound, delivered, during the entire year 1931. The price of metallurgical ingot, 98.99 per cent., was 22.9 cents a pound during the entire year 1931.

## The Design and Operation of Reaction Equipment

### Papers read before the American Chemical Society

INTERESTING papers of interest to chemical engineers throughout the world were read before the Division of Industrial and Engineering Chemistry of the American Chemical Society, at their Denver meeting, which was held this week. Dealing with "Equipment for Nitration and Sulphonation," R. Norris Shreve laid particular emphasis upon the design of the apparatus used, as regards proper stirring, heat transfer, separation of spent acid, and the various types of materials which are used for constructing the apparatus. Examples and some approximate industrial conditions for carrying on these procedures were given to illustrate various types of apparatus described.

"Contact Sulphuric Acid Converters," the subject of a paper by G. DuBois and T. R. Harney, described modern converter systems and gave a brief summary of present world practice in converters. The function of the contact sulphuric acid converter is to provide intimate contact between gas and catalyst and to provide as nearly as possible for optimum equilibrium conditions. Modern methods leading to the attainment of these ends are represented by all developments in internal heat exchange converters and by the so-called "two-pass" converter system in which heat exchangers are interposed between converters.

#### Amination by Ammonolysis

P. H. Groggins, on "Amination by Ammonolysis," gave some interesting points concerning the design and construction of equipment for this type of reaction between organic compounds (containing replaceable substituents) and ammonia. As this reaction generally takes place at elevated temperatures, it is essential for it to be carried out either in high pressure autoclaves or in tubular systems. Autoclaves are adapted for discontinuous or batch operations, whereas pipe systems are particularly suitable for continuous high pressure synthesis. Although direct fired systems were at one time quite prevalent, these have been supplanted by jacketed vessels heated with steam or circulated fluid, or by tubular systems immersed in molten alloys. Such systems provide a safer, more accurate, and practically automatic control of the amination process. The successful industrial preparation of amines by ammonolysis of organic halides, phenols and sulphonate acids depends largely on the proper functioning of the ammonia system. It is essential that the excess of aqueous ammonia which is used be recovered and returned to the reaction system at a constant and optimum strength. In properly conducted operations, the recovery is efficiently and almost automatically carried out by the choice of suitable equipment and the installation of mechanically controlled devices. Problems involved in the recovery of ammonia are (1) removal of the heat of solution, and (2) controlling the solubility by regulating the temperature, pressure and concentration of the aqueous ammonia in the absorption system.

#### Esterification Equipment

D. B. Keyes, dealing with "Esterification Processes and Equipment," gave a review of the various modern esterification processes used in the industries. The material for this paper was taken largely from the patent literature. The use of fractionating columns in these processes was discussed, as well as the fundamental factors of the processes.

A paper on "Oil Cracking Vessels" by Gustav Egloff, J. C. Morrell and E. C. Leonhardy covered riveted, hammer and electric welded and pierce-ingot type cracking vessels, with methods of fabrication, materials used, strength of vessels under various temperature pressure conditions, wall thickness, life of the vessels, and X-ray method of testing welds.

According to L. F. Marek, in his paper on "The Oxidation of Hydrocarbons," aromatic hydrocarbons require considerable oxidation in the presence of a catalyst at an elevated temperature before desirable intermediate products are formed. The intermediate products represent definite resistance points in the oxidation and permit high per pass yields. Apparatus, consisting of a large number of small, vertically supported catalyst tubes immersed in a liquid boiling at

reaction temperature permits the removal of large quantities of reaction heat at a reaction temperature of  $400^{\circ}$  to  $450^{\circ}$  C., and has been successfully used in the manufacture of phthalic anhydride, maleic anhydride, etc. Aliphatic hydrocarbons, particularly in the range of ethane to hexane, require only small proportions of oxygen to form the desired intermediate oxidation products. Resistance points in the stepwise reactions are not apparent and a different technique is necessary. Oxygen concentrations must be controlled at a low value, reaction must be rapid, and recirculation with intermediate product recovery employed. The application of high pressures to this oxidation has resulted in interesting yields of alcohols, acids, and other intermediate oxidation products. Numerous difficulties have prevented the extensive industrial application of these methods, but they present interesting possibilities.

#### High Pressure Problems

Some physico-chemical factors in high pressure design were dealt with by B. F. Dodge, who states that the rational design of chemical reaction equipment for use at high pressures must be based on scientific data concerning the properties of materials at the pressures and temperatures involved. The necessary data include such things as the tensile properties of metals and alloys, density or compressibility of gases and liquids, solubility, equilibrium constants, reaction velocities, etc. Among the topics discussed were gas densities at high pressure; specific heat of gases as affected by pressure; effect of pressure on chemical equilibrium; and gas-liquid equilibria under pressure.

Carbon as a neglected material of construction for reaction equipment was the subject of a paper by C. L. Mantell. Industrially, fabricated forms of amorphous carbon and graphite, because of their unusual resistance to chemical attack and corrosive influences, deserve greater consideration as a material of construction for reaction equipment than they have received to date. New applications will undoubtedly be made when the valuable properties of fabricated forms of carbon are more widely appreciated. The material has already shown exceptional performance in connection with acid manufacture, paper making, electrochemical industries, petroleum industries, combustion equipment, and as parts of machinery operating in chemical plants under severe conditions.

## Spanish Potash Production

#### Two Companies Operating

THE only two companies operating potash mines in Spain at present are the Union Espanola de Explosives, with mines in Cardona (Barcelona), and the Minas de Potasa de Suria S.A., Suria (Barcelona), which are operated by the Belgian Solvay et Cie. Production in 1929 was equivalent to 44,318 tons of 80 per cent. muriate produced in the mines of Suria. The Cardona mines were not operated during that year. Sales totalled 36,863 tons of domestic potash (80 per cent. basis) while imports were reported to have been 29,190 tons of potash having 50 per cent. K<sub>2</sub>O. Production in 1930 was equivalent to 51,675 tons of 80/84 per cent. basis muriate of potash from the mines of Suria, and 3,472 tons of 80 per cent. basis at Cardona. All of the 1930 sales of Cardona were in the domestic market. Suria's sales (80 per cent. KCl basis) were 27,545 tons in Spain and 21,182 tons for export. The 1930 imports totalled 24,646 tons of all classes of potash salts. Statistical data for 1931 are not as yet available.

#### Cinchona Bark in Dutch Indies

THE estimated production of cinchona bark for the entire Dutch Indies during 1932 is 7,725 metric tons divided 6,922 tons and 803 tons between Java and Outer Provinces respectively. In Java the March production amounted to 770 tons as compared with 200 tons for Outer Provinces, making a total of 970 tons for the entire Netherland India. The total production from January to March is 2,493 tons.

## News from the Allied Industries

### Mineral Oil

MR. KOJIRO MATSUKATA, a former president of the Kawasaki Dockyard, has left Tokyo for Baku on the invitation of the Soviet, ostensibly to examine the progress made under the Five Years Plan. According to the vernacular newspapers he proposes on his return to establish a Russo-Japanese oil company to import oil from Russia. Japanese importers, however, regard his visit as one of demonstration and inspection rather than a preliminary to any arrangement for large imports.

### Rubber

FURTHER IMPROVEMENT has to be recorded in the statistical position of rubber. As a result of last week's landings and deliveries, London stocks have declined by a further 727 tons to 46,986 tons, which compares with 81,751 tons a year ago, and Liverpool stocks have declined 220 tons to 57,542 tons, which compares with 54,722 tons last year. For some time past Russia has been absorbing increased quantities of rubber, and the continued fall in stocks is stated to be largely due to this buying. When figures for July become available, it is probable they will show a decline in stocks at the four principal points of about 14,000 tons compared with June. Outside of Russia, Japan is importing more rubber than last year, while there is every probability of an important Chinese demand when more favourable business conditions prevail in that country. The low price of rubber is steadily restricting production, and while a return to more profitable conditions in the industry is still somewhat off, progress towards normality is being steadily made.

### Whale Oil

A MEETING OF THE WHALERS' ASSOCIATION, representing all the companies sending floating factories for the 1932-33 whaling season took place at Sandefjord (Norway), on August 17, when it was decided, with only one dissentient group, that none of the members should sell whale oil for the price offered, *viz.*, £10 per barrel. During the meeting foreign whaling companies were approached as to their policy, and one of them replied that they did not propose to sell anything, but awaited developments in Norway.

### Iron and Steel

IT IS OFFICIALLY ANNOUNCED IN NEW YORK that Mr. Robert Patterson Lamont (United States Secretary of Commerce) has been elected president of the American Iron and Steel Institute in succession to Mr. Charles Schwab, who now becomes chairman of the Institute.

THE GERMAN IRON AND STEEL PRODUCTION underwent a further sharp decline last month. According to "Stahl und Eisen" the output of ingot steel fell from 19,456 tons in June to 16,485 tons per average working day in July, and the total production from 305,856 tons to 428,613 tons. In accordance therewith the rolling mills produced 11,850 tons per average working day in July, compared with 14,794 tons in June, their total production being 308,105 tons and 384,647 tons respectively. According to the statistics of the Federation of German Iron and Steel Industrialists the German blast furnaces turned out 294,485 tons of pig iron in July, in comparison with 300,921 tons in the preceding month. Compared with the 309,921 tons in the preceding month. Compared with the pig iron production of July, 1931, this year's figures amount to 51.73 per cent., and to only 18.30 per cent. of the monthly average production of the year 1913.

THERE IS A GENERAL DISPOSITION in the iron and steel trade to suspend judgment on the Ottawa agreements until the details are available. At the moment, iron and steel manufacturers are more or less in the dark as to the extent to which preferences have been granted to their products by the Dominions, and it is impossible for them to form a judgment on the rather vague information contained in the summaries published. It is hoped that the proposed discussions in London regarding the importation of Indian pig iron and semi-finished steel into this country free of duty may lead to some restriction of the severe competition which British manufacturers have had to face in their home markets from Indian pig iron sold at an uneconomic price.

### China Clay

CONSIDERING ALL THE BARRIERS placed against the china clay industry, artificial and economic, it is almost a wonder that its trade keeps so near the level of 50,000 tons per month. The industry, however, has received another setback by notice from the French Government that the shipment of china clay to France will be entirely stopped as from August 7, although the quota granted by the Government for the current period has not been fully shipped. The matter is now being taken up by the British Federation of Industries, but in the meantime the china clay producers are advised to hold up all pending shipments. The operation of the embargo implies that no importation of china clay will be permissible until a new decree is made.

### Oil-Seed Crushing

SEED CRUSHERS IN HULL, express themselves as bewildered by the imposition of a 10 per cent. duty on linseed, except Indian linseed, which is to enjoy a corresponding preference. Whilst the Indian crop which is to benefit is 400,000 tons, the Plate crop is 2,000,000 tons. It remains to be seen what prices the Indian growers will be prepared to take and whether shippers will reduce their rates. It is not possible at the moment to say whether the duty will affect market prices. Mr. Frederick Till thinks the Dutch and other foreign crushers of linseed will have an advantage over English crushers, as they will import seed free from duty. Unless a considerable compensating duty is added on linseed oil from Holland the consequences to Hull may be serious. At the beginning of August the price of Plate linseed was about £8 7s. 6d. per ton, as against Indian £11 per ton.

### Calcium Carbide

MAXIMUM capacity for calcium carbide in the four Yugoslav electro-chemical plants (Ruse, La Dalmatiense's two plants, and the Bosnian Electrical A.G.) is about 90,000 tons, of which La Dalmatiense controls approximately 25,000 to 40,000 tons, Ruse 16,000 to 20,000 tons, and the Bosnian Electrical 10,000 to 12,000 tons. Most of this carbide production goes into the manufacture of cyanamide. At present, only about 40,000 tons of carbide are being produced in the country. Exports have in the past been rather well sustained, 1930 total reaching 12,000 tons of carbide, declining slightly in 1931. The Bosnian Electrical A.G. is probably the most modern and well equipped plant in the production of calcium carbide, and of the factory's other lines, caustic soda, bleaching powder, and other chlorine derivatives. During 1930 the factory in Jajce was modernised.

### Matches

THE REPORT OF THE RECONSTRUCTION COMMITTEE of the Swedish Match Co., which was issued at Stockholm on August 22, recommends that the company should continue its activities and proposes a reconstruction scheme. The report says that, with the exception of the American group, which represents about 5 per cent. of the share capital, the representatives of the various interests are willing to recommend to the creditors they represent that the plans of the committee should be adopted. The committee has come to the conclusion that the continuation of the company's activities would be to the advantage of the creditors as well as the shareholders, and considers that the company has possibilities of eventually working itself out of its present dependent position. The bank representatives in the committee will therefore recommend a plan according to which the banks, as secured or unsecured creditors, will grant the company the necessary time for repayment of its loans, during which time interest and a certain amortisation will be paid, the latter depending on the company's yearly earnings. The reconstruction committee considers it necessary to state that practical considerations have made it desirable to maintain the capital, and that this must not be construed as an expression of opinion by the committee as to the value of the shares. The committee also points out that for some years to come the profits of the company will be required for the repayment of the company's debts and the consolidation of its resources generally.

## Weekly Prices of British Chemical Products

### Review of Current Market Conditions

The following notes on the chemical market conditions in Great Britain are based on direct information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Green and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

In the London chemical market prices remain generally steady with a fair demand. Prices are unchanged for coal tar products. At Manchester there has been no great difference in the general market position of most descriptions of chemical products. A good many buyers in the Manchester market are still on holiday and the annual stoppages in the industrial districts have still about a month to go before conditions may be said to be more or less normal. A disquieting influence is the prospect of a stoppage of operations at the cotton mills. If this develops an adverse effect on the bleaching, dyeing and finishing trades will be inevitable and this will react upon the movement of many lines of heavy chemicals. Business remains steady in the Scottish heavy chemical market and prices generally are stationary.

#### General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.  
 ACID, ACETIC.—Tech. 80%, £37 5s. to £39 5s.; pure 80% £38 5s. to £40 5s.; tech., 40%, £10 15s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. SCOTLAND: Glacial 98/100%, £48 to £50; pure 80%, £38 5s.; tech. 80%, £37 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech, glacial, £52.  
 ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in one-ton lots upwards.  
 ACID, CHROMIC.—11d. per lb., less 2½%, d/d U.K.  
 ACID, CITRIC.—1s. 6d. per lb. LONDON: 11d. less 5%. MANCHESTER: 1s.  
 ACID CRESYLIC.—97 99%, 1s. 5d. to 1s. 7d. per gal; 99/100%, 1s. 9d. to 2s.  
 ACID FORMIC.—London: £48 per ton.  
 ACID, HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.  
 ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s per ton; 50% by weight, £28 10s.; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.  
 ACID, NITRIC.—80° Tw. spot, £220 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.  
 ACID, OXALIC.—LONDON: £45 10s. per ton in casks, £48 10s. to £52 10s. in kegs. SCOTLAND: 98/100%, £49 to £52 ex store. MANCHESTER: £47, ex store.  
 ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations: 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.  
 ACID, TARTARIC.—11d. per lb. SCOTLAND: B.P. crystals, 1s. 1d. to 1s. 1½d. less 5%, carriage paid. MANCHESTER: 1s.  
 ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.  
 ALUMINA SULPHATE.—LONDON: £8 5s. to £9 10s. per ton. SCOTLAND: £8 to £8 10s. ex store.  
 AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.  
 AMMONIA LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb. d/d.  
 AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.  
 AMMONIUM CARBONATE.—SCOTLAND: Lump, £36 per ton; powdered, £38, in 5-cwt. casks d/d U.K. stations or f.o.r. U.K. ports.  
 AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also SALAMMONIAC.)  
 AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also SALAMMONIAC.)  
 ANTIMONY OXIDE.—SCOTLAND: Spot, £22 per ton, c.i.f. U.K. ports. ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb. according to quality.  
 ARSENIC.—LONDON: £24 10s. c.i.f. main U.K. ports for imported material; Cornish nominal, £26 10s. f.o.r. mines. SCOTLAND: White powdered £27 ex wharf; spot, £27 10s. ex store. MANCHESTER: White powdered Cornish, £25 10s. at mines.  
 ARSENIC SULPHIDE.—Yellow 1s. 6d. to 1s. 8d. per lb.  
 BARIUM CHLORIDE.—£11 per ton.  
 BISULPHITE OF LIME.—£7 10s. per ton f.o.r. London, packages free.  
 BLEACHING POWDER.—Spot 35/37% £7 10s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/cwt. casks.

BORAX, COMMERCIAL.—Granulated £15 10s. per ton, power £17, packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.  
 CADMIUM SULPHIDE.—3s. 6d. to 3s. 9d. per lb.  
 CALCIUM CHLORIDE.—Solid 70/75% spot £5 5s. to £5 15s. per ton d/d station in drums.  
 CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.  
 CARBON BLACK.—4½d. to 5½d. per lb., ex wharf.  
 CARBON TETRACHLORIDE.—£45 to £55 per ton, drums extra.  
 CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K. Green 1s. 2d. per lb.  
 CHROMETAN.—Crystals 3½d. per lb. Liquor £19 10s. per ton d/d.  
 COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.  
 CREAM OF TARTAR.—LONDON: £4 7s. 6d. per cwt.  
 FORMALDEHYDE.—LONDON: £28 per ton. SCOTLAND: 40%, £28 10s. ex store.  
 LAMBLACK.—£46 to £50 per ton.  
 LEAD, ACETATE.—LONDON: White, £34 per ton. Brown £1 per ton less. SCOTLAND: White Crystals £40 to £41 c.i.f. U.K. ports. Brown, £1 per ton less. MANCHESTER: White, £34; Brown, £32 10s.  
 LEAD NITRATE.—£28 per ton. MANCHESTER: £28.  
 LEAD, RED.—SCOTLAND: £28 10s. per ton d/d buyer's works.  
 LEAD, WHITE.—SCOTLAND: £40 per ton carriage paid.  
 LITHOPONE.—30%, £19 to £21 per ton.  
 MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.  
 METHYLATED SPIRIT.—6½d. O.P. Industrial 1s. 10d. to 2s. 3d. gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 6½d. O.P. id. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.  
 NICKEL AMMONIUM SULPHATE.—£52 per ton d/d.  
 NICKEL SULPHATE.—£52 per ton d/d.  
 PHENOL.—Small lots 6½d. to 6½d. per lb. in 3-cwt. drums, bulk quantities down to 5½d. per lb., delivery free U.K.  
 POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £40.  
 POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5½d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.  
 POTASSIUM CARBONATE.—SCOTLAND: 96/98% spot £28 per ton ex store. LONDON: £31 10s. to £32. MANCHESTER: £30.  
 POTASSIUM CHLORATE.—3½d. per lb. ex wharf London in 1-cwt. kegs. LONDON: £37 to £40 per ton. SCOTLAND: 99½/100% powder, £34. MANCHESTER: £37.  
 POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.  
 POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £28 per ton c.i.f. U.K. ports. Spot £30 per ton ex store.  
 POTASSIUM PERMANANATE.—LONDON: 8½d. per lb. SCOTLAND: B.P. crystals, 8½d. MANCHESTER: Commercial, 8½d.; B.P., 8½d.  
 POTASSIUM PRUSSIATE.—LONDON: 8½d. to 9d. per lb. SCOTLAND: Yellow spot material, 8½d. ex store. MANCHESTER: Yellow, 8½d.  
 SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels. SODA ASH.—58% spot, £6 per ton f.o.r. in bags, special terms for contracts.  
 SODA, CAUSTIC.—Solid 76/77% spot, £14 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums £18 15s. in casks. Solid 76/77% £14 10s. in drums 70/72% £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £12 15s. to £14 10s. contracts.  
 SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.  
 SODIUM ACETATE.—£21 to £22 per ton.  
 SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.  
 SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.  
 SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d 1-cwt. iron drums for home trade.  
 SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—2½d. per lb. LONDON: £29 per ton. MANCHESTER: £29.  
 SODIUM CHROMATE.—3d. per lb. d/d U.K.  
 SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals £15 ex station 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.  
 SODIUM NITRITE.—Spot, £10 to £22 per ton d/d station in drums.  
 SODIUM PERBORATE.—LONDON: 1d. per lb.  
 SODIUM PHOSPHATE.—£13 to £15 per ton.  
 SODIUM PRUSSATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5½d. ex store. MANCHESTER: 5d. to 6d.  
 SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station returnable drums.  
 SODIUM SULPHATE (GLACIER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.  
 SODIUM SULPHATE (SALT CAKE).—Ground Spot, £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d.  
 SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums. Crystals Spot £7 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.  
 SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot £9 10s. d/d station in bags.  
 SULPHATE OF COPPER.—MANCHESTER: £16 per ton f.o.b.  
 SULPHUR.—£12 5s. per ton. SCOTLAND: Flowers, £12 10s.; roll, £12 2s. rock, £9. Ground American, £12 ex store.  
 SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.  
 SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.  
 VERMILION.—Pale or deep, 5s. to 5s. 3d. per lb.  
 ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.  
 ZINC SULPHATE.—LONDON and SCOTLAND: £12 per ton.  
 ZINC SULPHIDE.—1s. to 1s. 2d. per lb.

### Pharmaceutical and Fine Chemicals

(Price Changes.)

ACID, CITRIC.—11d. per lb.  
 ACID, TARTARIC.—11½d. per lb.  
 BISMUTH SALTS.—Carbonate, 6s. 6d. per lb.; citrate, 8s. 10d.; nitrate (cryst.), 4s. 4d.; oxide, 10s.; salicylate, 7s. 3d.; subchloride, 4s. 10d.; subgalate, 6s. 11d.; subnitrate, 5s. 8d.  
 POTASSIUM CITRATE.—1s. 6d. per lb.  
 SODIUM CITRATE, B.P.C. 1911.—1s. 3d. per lb.; B.P.C. 1923 and U.S.P., 1s. 7d. per lb.

### Essential Oils

ALMOND, FOREIGN, S.P.A.—11s. 6d. per lb.  
 ANISE.—2s. per lb.  
 BERGAMOT.—11s. per lb.  
 BOURBON GERANIUM.—26s. 6d. per lb.  
 CAMPHOR, WHITE.—100s. per cwt.  
 CITRONELLA OIL, JAVA.—3s. 2d. per lb.  
 LEMON.—6s. per lb.  
 LEMONGRASS.—2s. 3d. per lb.  
 PEPPERMINT, JAPANESE.—4s. 3d. per lb.  
 PETITGRAIN.—5s. 6d. per lb.

### Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, B.P. (ex Toluid).—1s. 6d. per lb.  
 ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.  
 ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.  
 ACID, NEVILLE AND WINTHROP.—Spot, 3s. per lb. 100% d/d buyer's works.  
 ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.  
 ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.  
 ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.  
 BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.  
 BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.  
*o*-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.  
*m*-CRESOL 48/100%—2s. 6d. per lb., in ton lots.  
*p*-CRESOL 34-35° C.—1s. 9d. per lb., in ton lots.  
 DICHLORANILINE.—2s. per lb.  
 DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.  
 DINITROKORENZONE.—8½d. per lb.  
 DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 9d. per lb.  
 DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.  
 $\alpha$ -NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.  
 $\beta$ -NAPHTHOL.—Spot, £75 per ton in 1-ton lots. d/d buyer's works.  
 $\alpha$ -NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.  
 $\beta$ -NAPHTHYLAMINE.—Spot, 2s. 6d. per lb. d/d buyer's works.  
*o*-NITRANILINE.—5s. 10d. per lb.  
*m*-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

*p*-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.  
 NITROBENZENE.—Spot, 5d. per lb.; 5-cwt. lots, drums extra.  
 NITRONAPHTHALENE.—9d. per lb.  
 SODIUM NAPHTHIONATE.—Spot, 1s. 6d. per lb.  
*p*-TOLUIDINE.—Spot, 9d. per lb., drums extra, d/d buyer's works.  
*p*-TOLUIDINE.—Spot, 1s. 11d. per lb., d/d buyer's works.  
*m*-XYLIDINE ACETYL.—3s. 6d. per lb., 100%.

### Coal Tar Products

ACID, CARBOLIC (CRYSTALS).—5d. to 6½d. per lb. Crude, 60's 1s. 5d. to 1s. 6d. per gal. SCOTLAND: Sixties, 1s. 7d. to 1s. 8d.  
 ACID, CRESYLIC.—90/100, 1s. 7d. per gal.; B.P., 1s. 10d. to 1s. 12d.; Refined, 1s. 8d. to 1s. 10d.; Pale, 98%, 1s. 10d. to 1s. 12d.; Dark, 1s. 3d. to 1s. 4d. LONDON: 98/100%, 1s. 6d. Dark 95/97%, 1s. 4d. SCOTLAND: Pale 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark 97/99%, 11d. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.  
 BENZOL.—At works, crude, 8½d. to 10d. per gal. Standard motor, 1s. 3d. to 1s. 4d.; 90%, 1s. 4d. to 1s. 5d. Pure, 1s. 7d. to 1s. 8d. LONDON: Motor, 1s. 5d. SCOTLAND: Motors, 1s. 3d. to 1s. 4d.; 90%, 1s. 6d. to 1s. 10d.  
 CREOSOTE.—Standard for export, 4½d. to 5d. nett per gal. f.o.b. for Home, 3d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 3d. to 4d. SCOTLAND: Specification oils, 3d. to 4½d.; washed oil, 4d. to 4½d.; light, 3d. to 4½d.; heavy, 4½d. to 5d.  
 NAPHTHA.—Solvent, 90/160, 1s. 4d. to 1s. 5d. per gal.; 95/160, 1s. 4½d.; 90/190, 1s. 1d. to 1s. 2d. LONDON: Solvent, 1s. 1½d. to 1s. 2d.; heavy, 11d. to 1s. 10d. f.o.r. SCOTLAND: 90/160, 1s. 3d. to 1s. 3½d.; 90/190, 1s. 1d. to 1s. 2d.  
 NAPHTHALENE.—Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 65s. to 70s.  
 PYRIDINE.—90/140, 3s. 9d. per gal.; 90/160, 4s. to 4s. 6d.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160%, 4s. to 5s.; 90/220%, 3s. to 4s.  
 REFINED COAL TAR.—SCOTLAND: 4½d. to 5d. per gal.  
 TOLUOL.—90%, 2s. 1d. to 2s. 2d. per gal.; Pure, 2s. 5d. to 2s. 6d.  
 XYLOL.—1s. 9d. per gal.; Pure, 1s. 11d.

### Wood Distillation Products

ACETATE OF LIME.—Brown, £8 5s. per ton. Grey, £10 10s. to £12. Liquor, brown, 30° Tw., 6d. per gal. MANCHESTER: Brown, £8 10s.; grey, £11 10s.  
 ACETIC ACID, TECHNICAL, 40%.—£16 10s. to £18 per ton.  
 ACETONE.—£6 10s. to £65 per ton.  
 AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.  
 CHARCOAL.—£6 10s. to £11 per ton.  
 IRON LIQUOR.—24°-30° Tw., 10d. to 1s. 2d. per gal.  
 WOOD CREOSOTE.—6d. to 2s. per gal., unrefined.  
 WOOD NAPHTHA, MISCELLY.—2s. 6d. to 4s. per gal. Solvent, 3s. 9d. to 4s. 6d. per gal.  
 WOOD TAR.—£2 to £6 per ton.  
 BROWN SUGAR OF LEAD.—£32 per ton.

### Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The export market is quiet, but the price remains steady at £4 10s. per ton f.o.b. U.K. port in single bags. In the home market sales have been made at the price of £5s. per ton delivered in 6-ton lots to formers' nearest station, but at the moment buying is small.  
 NITRATE OF SODA.—The prices for 10½ 3 have now been announced at £8 8s. per ton delivered in 6-ton lots to farmers' nearest station for September delivery, advancing by steps to £8 16s. per ton for February/June.  
 NITRO-CHALK.—The price remains unchanged at £7 5s. per ton delivered in 6-ton lots.

### Latest Oil Prices

LONDON, August 24.—LINSEED OIL was firm. Spot, small quantities, £18; Sept., £15 2s. 6d.; Sept.-Dec., £15 10s.; Jan.-April, £16 10s.; May-Aug., £17 10s. per ton, naked. RAPE OIL was quiet. Crude extracted, £28 10s.; technical refined, £30 10s. per ton, naked, ex wharf. COTTON OIL was steady. Egyptian crude, £23; refined common edible, £26; and deodorised, £28 per ton, naked, ex mill. TURPENTINE was firm. American, spot, 61s. 6d. per cwt.  
 HULL.—LINSEED, spot, £15 12s. 6d.; Aug. closed at £15 2s. 6d.; Sept.-Dec., £15 7s. 6d.; Jan.-April, £16. COTTON OIL.—Egyptian crude, spot, £23; edible refined and technical, £25 10s.; deodorised, £26 10s.; naked. PALM KERNEL OIL, crude, naked, f.m.q., spot, £22. GROUNDNUT OIL, crushed-extracted, spot, £31; deodorised, £35. RAPE, crushed-extracted, spot, £28; refined, £29 10s. SOYA OIL, crushed-extracted, spot, £23 10s.; deodorised, £26 10s., all per ton. COD OIL, 15s. 6d. per cwt. in barrels. CASTOR OIL, pharmacy, spot, in barrels, 41s. 6d.; firsts, 36s. 6d.; seconds, 31s. 6d. per cwt. TURPENTINE, American, spot, 62s. 6d. per cwt.

## Inventions in the Chemical Industry

### Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications Accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

#### Specifications Accepted with Dates of Applications

MANUFACTURE AND PRODUCTION OF WETTING, CLEANSING, DISPERSING, AND THE LIKE AGENTS. J. Y. Johnson (*I. G. Farbenindustrie*). May 1, 1931. 378,383.

HEAT-EXCHANGING APPARATUS. G. Mertens. May 20, 1930. 378,439.

MANUFACTURE AND PRODUCTION OF URETHANE DERIVATIVES. J. Y. Johnson (*I. G. Farbenindustrie*). May 6, 1931. 378,390.

MANUFACTURE OF PHENOL OR ITS HOMOLOGUES. Dr. F. Raschig Ges. May 6, 1930. 378,487.

PRODUCTION OF SOLIDIFIED CARBON DIOXIDE. W. L. Smith. May 8, 1931. 378,490.

MANUFACTURE OF WETTING, EMULSIFYING, AND DETERGENT AGENTS. Imperial Chemical Industries, Ltd., A. J. Hulwood and A. W. Baldwin. May 11, 1931. 378,454.

CONCENTRATION OF DILUTE ACETIC ACID OR LIQUOR CONTAINING SAME. Distillers Co., Ltd., H. Langwell and R. Gilmour. May 12, 1931. 378,493.

RECOVERY OF SULPHUR DIOXIDE FROM GASES CONTAINING THE SAME. A. M. Clark and Imperial Chemical Industries, Ltd. May 12, 1931. 378,404.

PROCESS FOR THE MANUFACTURE OF CALCIUM BORIDE. A. Carpmael (*I. G. Farbenindustrie*). May 12, 1931. 378,460.

PRODUCTION OF ESTERS. Usines de Melle. May 16, 1930. 378,498.

MANUFACTURE OF PENTAERYTHRITOL TETRANITRATE. T. R. Paterson and Imperial Chemical Industries, Ltd. May 13, 1931. 378,500.

PRODUCTION OF AROMATIC HYDROCARBONS FROM PHENOLS. W. R. Madel, D. R. H. Hurtley, and Imperial Chemical Industries, Ltd. May 13, 1931. 378,501.

METHOD OF INCORPORATING PLASTICISERS AND ACTIVATORS INTO RUBBER. Goodyear Tire and Rubber Co. June 19, 1930. 378,518.

MANUFACTURE AND APPLICATION OF ACCELERATORS FOR VULCANISATION. A. Carpmael (*I. G. Farbenindustrie*). May 15, 1931. (Samples furnished). 378,525.

MANUFACTURE AND PRODUCTION OF POLYMERISATION PRODUCTS FROM VINYL ETHERS. J. Y. Johnson (*I. G. Farbenindustrie*). May 18, 1931. 378,544.

TEXTILE PRINTING BY MEANS OF SULPHUR DYESTUFF PREPARATIONS. A. Carpmael (*I. G. Farbenindustrie*). May 20, 1931. 378,553.

PRODUCTION OF SYNTHETIC RESINS FROM ALCOHOLAMINES AND ORGANIC ACIDS. Dr. K. Albert Ges. Chemische Fabriken. April 17, 1931. 378,596.

MANUFACTURE AND PRODUCTION OF DYESTUFFS. J. Y. Johnson (*I. G. Farbenindustrie*). June 26, 1931. 378,604.

MANUFACTURE OF LACQUERS, FILMS, COATING PREPARATIONS, ADHESIVES, IMPREGNATING AGENTS AND THE LIKE. I. G. Farbenindustrie. July 7, 1930. 378,608.

PROCESS FOR OBTAINING AND SEPARATING PHYSIOLOGICALLY-ACTIVE SUBSTANCES FROM PLACENTA. I. G. Farbenindustrie. Aug. 26, 1930. 378,647.

RECOMPOSING RAW PHOSPHATES. M. C. Wade and W. S. Sharpe. Sept. 8, 1931. 378,670.

MANUFACTURE OF 1,2-DIBROMO-2-HYDROXY-NAPHTHALENE-3-CARBOXYLIC ACID. W. W. Groves (*I. G. Farbenindustrie*). Sept. 17, 1931. 378,676.

PRODUCTION OF ALKALI SULPHATES AND SULPHUR. Metallges A.-G. May 13, 1931. 378,684.

MANUFACTURE OF TERTIARY NITRILES. I. G. Farbenindustrie. Dec. 10, 1930. 378,743.

PROCESS FOR DYEING ARTIFICIAL SILKS PREPARED FROM REGENERATED CELLULOSE IN LEVEL BLUE TO BLUE-VIOLET SHADES. Chemische Fabrik vorin. Sandoz. Dec. 16, 1930. 378,750.

PROCESS FOR THE MANUFACTURE OF ALIPHATIC AND HYDROAROMATIC OXIDES. Schering-Kahlbaum A.-G. Jan. 14, 1931. 378,759.

PROCESS FOR INCORPORATING METAL COMPOUNDS IN TEXTILE MATERIALS. British Bemberg, Ltd. Dec. 31, 1930. 378,760.

SEPARATION OF GASEOUS MIXTURES BY LIQUEFACTION. M. Frankl. Nov. 16, 1931. 378,769.

PROCESS FOR MAKING GLASS, ENAMELS, GLAZES, AND THE LIKE CONTAINING LEAD. P. Beyersdorfer. Feb. 18, 1932. 378,799.

PROCESS FOR REFINING SUGAR, OR SUBSTANCES CONTAINING SAME, SUCH AS BEET PULP, BEET SLICES, CRUSHED SUGAR-CANE, AND THE LIKE. I. Traube. April 15, 1931. 378,832.

MANUFACTURE OF LIGHT-SENSITIVE PHOTOGRAPHIC MATERIAL. Kodak, Ltd. June 11, 1930. 22043/32.

PROCESS FOR PRODUCING BUTYL ALCOHOL AND ACETONE. Smith Corporation, A. O. Aug. 6, 1931. 22044/32.

TITANIUM PIGMENTS AND PAINTS. Titanium Pigment Co., Inc. Aug. 6, 1931. 22075/32.

PROCESS FOR MANUFACTURE OF SOLUBLE ARSENO-BISMUTH COMPOUNDS. I. G. Farbenindustrie. Aug. 6, 1931. 22146/32.

PRODUCTION OF TITANIUM OXIDE PIGMENTS. Krebs Pigments, and Color Corporation. Aug. 7, 1931. 22193/32.

PROCESS FOR THE PRODUCTION OF BERYLLIUM FLUORIDE. I. G. Farbenindustrie. Aug. 13, 1931. 21099/32.

PROCESS FOR THE MANUFACTURE OF ACETOETHYL ALCOHOL. I. G. Farbenindustrie. Aug. 13, 1931. 21314/32.

PLASTIC COMPOSITIONS. Carbide and Carbon Chemicals Corporation. Aug. 10, 1931. 21870/32.

HYDROGENATION OF ORGANIC COMPOUNDS. Röhm and Haas Co. Aug. 12, 1931. 22060/32.

TREATMENT OF CELLULOSE ESTERS CONTAINING COLLOIDING AGENTS. E. I. Du Pont de Nemours and Co. Aug. 12, 1931. 22023/32.

MANUFACTURE OF DIBENZANTHRONE DERIVATIVES. Imperial Chemical Industries, Ltd. Aug. 15, 1931. 22816/32.

MANUFACTURE OF CALCIUM CYANAMIDE. Akt.-Ges. für Stickstoffdunger. Aug. 15, 1931. 22826/32.

#### Applications for Patents

PULVERISING COAL. Imperial Chemical Industries, Ltd. August 13, 22763.

PRODUCTION OF TITANIUM OXIDE PIGMENTS. Krebs Pigment and Colour Corporation. August 8. (United States, August 7, '31.) 22193.

PREPARATION OF NATURALLY OCCURRING ENZYME, ETC. N. U. Meldrum and F. J. W. Roughton. August 10. 22408.

PREPARATION OF AROMATIC SULPHIDE COMPOUNDS. Naugatuck Chemical Co. August 8. (United States, September 5, '31.) 22200.

HYDROGENATION OF ORGANIC COMPOUNDS. Röhm & Haas Co. August 12. (United States, August 12, '31.) 22600.

MOULDING-COMPOSITIONS. (Shawinigan Chemicals, Ltd.). August 12. 22584.

MOULDED ARTICLES OF RESINOUS MATERIALS. Shawinigan Chemicals, Ltd. August 13. 22738.

MANUFACTURE OF CHLOROSULPHONIC ACID. Soc. of Chemical Industry in Basle. August 8 (Switzerland, August 17, '31.) 22206.

MANUFACTURE OF CALCIUM CYANAMIDE. Akt.-Ges. für Stickstoffdunger. Aug. 15. (Germany, Aug. 15, '31.) 22826.

CONTINUOUS REFINING OF HYDROCARBONS. Aktiebolaget Separatoren Nobel. Aug. 18. (Germany, Sept. 25, '31.) 23177.

PRODUCTION OF HIGHER KETONES. British Industrial Solvents, Ltd. Aug. 15. (Germany, Aug. 16, '31.) 22832.

SULPHUR DYESTUFFS. E. Chapman, Imperial Chemical Industries, Ltd., and W. B. Waddington. Aug. 17. 23118.

PRODUCTION OF WATER-FREE ALCOHOLIC LIQUID MIXTURES. Deutsche Gold-und Silber-Scheideanstalt vorin. Roessler. Aug. 15. (Germany, Aug. 17, '31.) 22808.

MANUFACTURE OF ORGANIC COMPOUNDS CONTAINING FLUORINE. E. I. Du Pont de Nemours and Co. Aug. 10. 23293.

MANUFACTURE OF DYESTUFF INTERMEDIATE. N. H. Haddock, Imperial Chemical Industries, Ltd., and F. Lodge. Aug. 17. 23110.

MANUFACTURE OF MASSES FOR PURIFICATION OF GASES. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 17. 23090.

IMPROVING LUBRICATING OILS, ETC. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 17. 23091.

LOWERING SETTING POINTS OF OILS. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 17. 23092.

MANUFACTURE OF AMIDES OF HIGHER FATTY ACIDS. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 17. 23093.

MANUFACTURE OF AMMONIUM SALTS OF PHOSPHORIC ACID. I. G. Farbenindustrie. Aug. 18. (Germany, Aug. 18, '31.) 23173.

MANUFACTURE OF COMPOSITE TITANIUM PIGMENTS. I. G. Farbenindustrie. Aug. 18. (Germany, Aug. 19, '31.) 23199.

MANUFACTURE OF DIBENZANTHRONE DERIVATIVES. Imperial Chemical Industries, Ltd. Aug. 15. (United States, Aug. 15, '31.) 22816.

DISZO DYESTUFFS. Imperial Chemical Industries, Ltd., and C. Paine. Aug. 16. 22054.

PRODUCTION OF CHLORINATED RUBBER PRODUCTS. Imperial Chemical Industries, Ltd. Aug. 17. 23120.

PRODUCTION OF POTASSIUM CARBONATE. Kali-Chemie Akt.-Ges. Aug. 15. (Gotha, Sept. 20, '31.) 22843, 22844.

PRODUCTION OF POTASSIUM CARBONATE. Kali-Chemie Akt.-Ges. Aug. 15. (Gotha, Sept. 20, '31.) 22809.

MANUFACTURE OF ORGANIC COMPOUNDS CONTAINING FLUORINE. W. A. Lazier. Aug. 10. 22203.

TREATMENT OF LIQUIDS WITH REAGENTS. Paterson Engineering Co., Ltd. Aug. 16. 22066.

STRAINER SYSTEMS FOR FILTERS. Paterson Engineering Co., Ltd. Aug. 17. 23105.

## From Week to Week

A NEW OILFIELD has been discovered between Erzerum and Erzincan, in Armenia. A Turkish bank is surveying the area.

IN THE ARTICLE ON UNCREASABLE COTTON FABRICS which was published in *THE CHEMICAL AGE*, August 20, 1932, page 174, the patents references cited should read 291,473, 291,474, and 304,900.

THE RUSSIAN NAPHTHA PRODUCTION during the first seven months of the current year totalled 13,002,800 tons, or 564,400 tons more than in the corresponding period of last year. This year's output, however, was still 9.3 per cent. below the estimate.

RECENT WILLS include:—The Right Hon. Herbert Clark, Baron Merthyr of Senghenydd, of Hearn Castle, Saundersfoot, Pembs., and 32 Queen Anne's Gate, London, chairman of Melingriffith Ltd., tin-plate manufacturers in Cardiff. £518,593 (net personality £471,736).

THE BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, London, E.C.4, are removing their London warehouse from 34-38 Banner Street, Golden Lane, E.C.1, to 23-25 Pancras Road, N.W.1, as from August 29.

PROFESSOR H. D. KAY, Ph.D., D.Sc., has been appointed director of the National Institute for Research in Dairying, at Reading, in succession to the late Professor Stenhouse Williams. Dr. Kay, who is resigning the professorship of biochemistry in the University of Toronto in order to take up his appointment at Reading, has been engaged in research work in biochemistry at various times in the Universities of Cambridge, London, Manchester, and Toronto.

A COMPLETE EQUIPMENT FOR X-RAY WORK, in connection with cotton research, is at present being installed at the Shirley Institute, Didsbury. Investigations carried out in Germany by the X-ray technique applied to artificial silk filaments are held to have brought much benefit to another branch of the textile industry and improved products are to be expected in both instances. Vital factors in the wearing and draping properties of fabrics can be studied by this means.

DAMAGE ESTIMATED AT £6,000 was caused by fire at the works of the British Recovered Rubber and Chemical Co., Ltd., Ashton New Road, Manchester, on August 22. At these works, which normally employ about forty people, old rubber tyres are ground up, boiled, and rolled out into material for fresh use. A watchman at the Clayton Aniline Works discovered the outbreak and gave the alarm, and the fire brigade, with nine engines, were able to confine the fire to the block in which it originated.

DEALING WITH CHEMICAL INDUSTRY in an industrial survey of the North-East Coast, prepared by Professor H. M. Hallsworth, of the Department of Economics at Armstrong College, Newcastle, it is stated that developments at the premises of Imperial Chemical Industries, Ltd., Billingham-on-Tees, led to an increase in the number of persons employed. Between from 5,000 in 1923 to 15,700 in 1929. Since 1929 the number has declined to 14,000 in 1930 and 6,000 in 1931.

A SCHEME HAS BEEN INTRODUCED at Bristol whereby the Great Western Railway, by the medium of its railhead distribution now undertakes the prompt delivery in a considerable area of supplies of solid carbon dioxide ("Drikold") manufactured by Imperial Chemical Industries. At present this material is sold in 25 and 50 lb. blocks, and supplied to firms for various uses, including the aeration of mineral waters and beer, the maintenance of ice cream, and the preservation of perishable foodstuffs during transport and in the shops.

THE RESEARCH COUNCIL OF ALBERTA (Canada) reports a discovery which will cheapen the extraction of oil or bitumen from the McMurray tar sands. For some years research has been carried on into methods of separating oil from the bituminous sands which are a very extensive resource in the Athabasca valley. The investigators, Dr. K. A. Clark and Dr. D. S. Pasternack, now report that practically 100 per cent. of the oil or bitumen can be recovered by using a solution of soda ash. The secret of bituminous sand separation by hot water is very simple and depends on neutralising the acid in the sand by the addition of a suitable alkali. Soda ash has been found to be the proper chemical to use and incidentally, is much cheaper than the chemical, waterglass, which was used previously.

THE NEW SESSION of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C.3, which extends over about 36 weeks, will begin on Monday, September 19, and students will be enrolled during the preceding week. The institute provides instruction in pure and applied mathematics, physics, chemistry, botany, zoology, biochemistry of fermentation (including malting and brewing), petroleum technology, fuel technology (including coal carbonisation and gas manufacture), metallurgy, assaying, geology, modern languages, arts and crafts and tailoring. The evening science courses are arranged to meet the requirements of those engaged in chemical, metallurgical, petroleum and fermentation industries. Full facilities are provided in well-equipped laboratories for special investigations and research.

CRANE, LTD., formerly Crane-Bennett, Ltd., have vacated their premises at 120 Pall Mall, London, S.W.1. Their new address is 45/51 Leman Street, E.1. Telephone: Royal 7343 (12 lines). Cables: "Cranelon, London."

CHILE IS NEGOTIATING with the United States Federal Farm Board for the barter of at least 40,000 tons of nitrate for about 2,000,000 bushels of wheat. The nitrate is to be acquired by the War Department and held as a military reserve, in order to mollify domestic nitrate producers.

DAMAGE TO THE EXTENT OF £10,000 was done at a fire at the factory of the Nuneaton Wool and Leather Co., Nuneaton, on August 19, when the main block of the factory, which was recently installed with new machinery for the manufacture of leather goods, was burned out.

IT IS REPORTED that tenders are likely to be called for in the near future for the construction of a hydro-electric plant at the Assuan Dam and a fertiliser factory near Kem Ombo, the electric plant to be operated solely for the needs of the nitrogen fixation plant and not for the transmission of power to distant points.

IT IS UNDERSTOOD that the whole of the rights of the Salerni process of low temperature carbonisation of coal, tested in the laboratories of the Fuel Technology Department of the University of Sheffield, have been acquired by Neanthracite, Ltd., of which Sir Eric Hambro is chairman. Experimental work is being carried on in retorts in Sheffield, including the Neanthracite retort which has been installed at the company's works. It has not yet been decided where the full-scale plant will be erected. From low-grade coal there is said to have been produced a fuel practically smokeless, of a density equal to hard metallurgical coke, but with the qualities of high-grade coal. By-products, including oil and gas, have also been collected.

HIGH RECORDS OF THE TIME-KEEPING of those employed in the various heavy chemical works throughout the country are disclosed in a report to the Chemical Trades Joint Industrial Council. The demand is that the day men shall not lose more than five days without reasonable excuse in the year, and shift men not more than six shifts without reasonable excuse, to qualify for the annual holiday with pay. Throughout the whole trade no less than 98.95 per cent. qualified in 1932, whilst 97.64 per cent. qualified in 1931. Imperial Chemical Industries (Alkali), Ltd., who had in operation a scheme of holidays with pay before its general adoption by the trade, have a stricter qualification, as in their case an employee must not lose more than two days or two shifts without reasonable excuse. In 1932, 99.64 per cent. qualified; in 1931, 99.82 per cent.

### Obituary

JAMES ERNEST ASPIN, of James Aspin and Sons, varnish manufacturers, Glasgow.

MR. DAVID CROSS, J.P., Bishopton, at one time was a partner of David Cross and Sons, manure merchants, Glasgow. Aged 80 years.

SIR WILLIAM CLEGG, one of the founders of Sheffield University, of which he was a pro-chancellor, and chairman of the Applied Science Department. Sir William, who was 80 years old, had done great work for Sheffield. He was Lord Mayor of Sheffield in 1898 and was knighted in 1906.

SIR WILLIAM PEARCE, of Walmer, Kent. Aged 70 years. Sir William was a vice-president of the Federation of British Industries. During the war he gave valuable assistance to the Government on chemical matters. He retained, until the last, his interest in Spencer, Chapman and Messel, Ltd., chemical manufacturers, of which he was a director.

### Books Received

CORNELIS DREBBEL (1572-1633). By Dr. G. Tierie. Amsterdam: H. J. Paris. Pp. 124. 4s. 6d.

BULLETIN OF THE IMPERIAL INSTITUTE.—Vol. XXX, No. 2. 1932. London: John Murray. Pp. 262. 3s. 6d.

ECONOMIC CONDITIONS IN TURKEY. Report by Colonel H. Woods, Department of Overseas Trade. London: H.M. Stationery Office. Pp. 46. 1s. 6d.

THIRD AND FINAL REPORT OF THE ADHESIVES RESEARCH COMMITTEE. Department of Scientific and Industrial Research. London: H.M. Stationery Office. Pp. 110. 2s. 6d.

TABLES OF CUBIC CRYSTAL STRUCTURE OF ELEMENTS AND COMPOUNDS. By I. E. Knaggs and B. Karlak. London: Adam Hilger, Ltd. Pp. 90. 1s. 6d.

ECONOMIC CONDITIONS IN YUGOSLAVIA. May, 1932. Report by H. N. Sturrock. Department of Overseas Trade. London: H.M. Stationery Office. Pp. 36. 1s.

THE ROADWAY GOODS TRANSPORT GUIDE FOR THE BRITISH ISLES. 1932-33. London: Roadway Publications. Pp. 544. 12s. 6d.

## Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

### Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an \*—followed by the date of the Summary, but such total may have been reduced.]

**Bussey Coal Distillation Co., Ltd.**, London, S.W. (M. 27/8/32.) Satisfaction registered August 10, £10,000 and £10,000 registered April 8, 1930.

**Cement Industries, Ltd.**, London, S.W. (M. 27/8/32.) Registered August 12, £10,600 debentures, part of £70,000; general charge.

**Illingworth Carbonization Co., Ltd.**, Manchester. (M. 27/8/32.) Registered August 11, £1,600, £500 and £2,000 debentures, part of £50,000 (not ex.); general charge. \*£12,500. January 12, 1932.

## New Chemical Trade Marks

Opposition to the registration of the following trade marks can be lodged up to September 10, 1932.

**Kaocol.** 533,364. Class 3. Chemical substances prepared for use in medicine and pharmacy. Burgoine, Burbidges & Co., Ltd., High Street South, East Ham, London, E.6. July 12, 1932.

**Mirpol.** 533,387. Class 1. Chemical substances for use as wetting-out agents in the treatment of textile fabrics in the course of manufacture. Mirvale Chemical Co., Ltd., Steanard Lane, Mirfield, Yorkshire. July 12, 1932.

**Crisolipol.** 532,597. Class 3. Chemical substances prepared for use in medicine and pharmacy. May & Baker, Ltd., Garden Wharf, Church Road, Battersea, London, S.W.11. June 18, 1932.

**Rustodian.** 533,298. Class 1. Pigments, paints and enamels (in the nature of paints.) The Cookson Lead & Antimony Co., Ltd., Milburn House, Dean Street, Newcastle-upon-Tyne. July 8, 1932.

Opposition to the registration of the following trade mark can be lodged up to September 17, 1932.

**Pyefy.** 533,512. Class 2. Chemical substances used for agricultural, horticultural, veterinary and sanitary purposes. Stafford Allen & Sons, Ltd., 7 Cowper Street, Finsbury, London, E.C.2, and Long Melford, Suffolk. July 16, 1932.

## Chemical Trade Inquiries

Abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

**British India.**—A Calcutta firm desires agencies for India, on commission or consignment, for chemicals. (Ref. No. 233.)

**Roumania.**—A commission agent in Galatz desires to get into touch with United Kingdom dealers in drugs and tallow for soap factories. (Ref. No. 263.)

**Italy.**—A firm in Savona is desirous of representing United Kingdom manufacturers of pig iron, rod iron and tinplates, on a commission basis. (Ref. No. 262.)

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**British India.**—An old-established Hindu firm at Secunderabad-Deccan desires consignment agencies for scientific instruments and laboratory equipment for Hyderabad-Deccan. (Ref. No. 232.)

**Roumania.**—The Commercial Secretary to H.M. Legation at Bucharest reports that the Roumanian Government is calling for tenders, to be presented in Bucharest by September 17, for the supply of various chemicals, drugs, etc. (Ref. F.X. 1570.)

**Belgium.**—A British commission agent, temporarily residing in the district of Ghent, is desirous of obtaining the representation of United Kingdom manufacturers of paints and varnishes for industrial uses. Business is desired on a "commission plus small salary and travelling expenses" basis. (Ref. No. 258.)

**Canada.**—A firm of manufacturers' agents at Toronto are prepared to represent United Kingdom manufacturers of glass bottles for fruit and vegetable preserves and medicines, and for all liquids sold through drug and chain stores. The firm work usually on a commission basis, and are prepared to cover the whole of Eastern Canada. (Ref. No. 245.)

**South Africa.**—H.M. Trade Commissioner at Johannesburg reports that the South African Railways and Harbours Administration is calling for tenders (Tender No. 2075), to be presented in Johannesburg by October 17, 1932, for the supply of about 67,900 gallons of motor lubricating oils and 14,550 lbs. of cup grease required during the period January 1, 1933 to December 31, 1933. (Ref. B.X. 7397.)

**United States.**—H.M. Vice-Consul at New York reports that a local firm of refiners and distributors of lubricating, vegetable and fish oils, etc., desire to obtain from United Kingdom exporters supplies of ammonium carbonate; degras; liquid ammonia; graphite; aluminium stearate; hemlock extract; caustic soda; colloidal clay; lamp black; lime; lard oil; litharge; cod oil; potash; plumbago; tri-sodium phosphate and tallow. (Ref. B.X. 7396.)

### Other Inquiries

**Red Seal Lye.**—A subscriber wishes to know the actual composition and strength of "Red Seal Lye." (Ref. C.A. 184.)

## Company News

**William Blythe & Co.**—The directors have declared an interim dividend of 2 per cent., actual, less tax, on the ordinary shares.

**John Oakey & Sons.**—An interim dividend of 2½ per cent., less tax, is announced on the ordinary shares, payable on September 1.

**Eastwoods Cement, Ltd.**—A net profit of £14,068 is reported for the year ended March 31, 1932, compared with £17,587 in the previous twelve months. It is proposed to pay a dividend of 6 per cent. on the ordinary shares.

**Pinchin, Johnson & Co., Ltd.**—The directors have declared an interim dividend of 7½ per cent. actual, less tax, on the ordinary shares, payable September 8. A year ago the ordinary interim was 10 per cent., less tax at 4s. 6d., equivalent to a dividend of 10½ per cent., less tax at 5s. This was followed by a final of 7½ per cent., making a total distribution for the year 1931 of 17½ per cent., less tax. In 1930, 22½ per cent. was paid, 10 per cent. as an interim and 12½ per cent. as a final.

**Calico Printers' Association, Ltd.**—For the year just ended, profit (subject to audit), after providing £359,970 for maintenance, depreciation, repairs, renewals, and upkeep, and £128,000 for debenture interest, was £157,458, which is stated to be the highest figure realised since 1927-28. In the previous twelve months there was a loss of £175,289, after charging £882,540 for depreciation, &c., and £128,000 for debenture interest. In February last the half-year's preference dividend was deferred. The directors now recommend that a dividend be declared on the preference stock for the year ended June 30 last at the rate of 5 per cent. per annum (less tax), but they are unable to recommend any payment on the ordinary stock, the surplus of £10,476 being carried forward. A year ago £250,000 was transferred from dividend equalisation fund, and £50,000 from general reserve, to meet the preference dividend and other charges.

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